SCIENTIFIC AMERICAN

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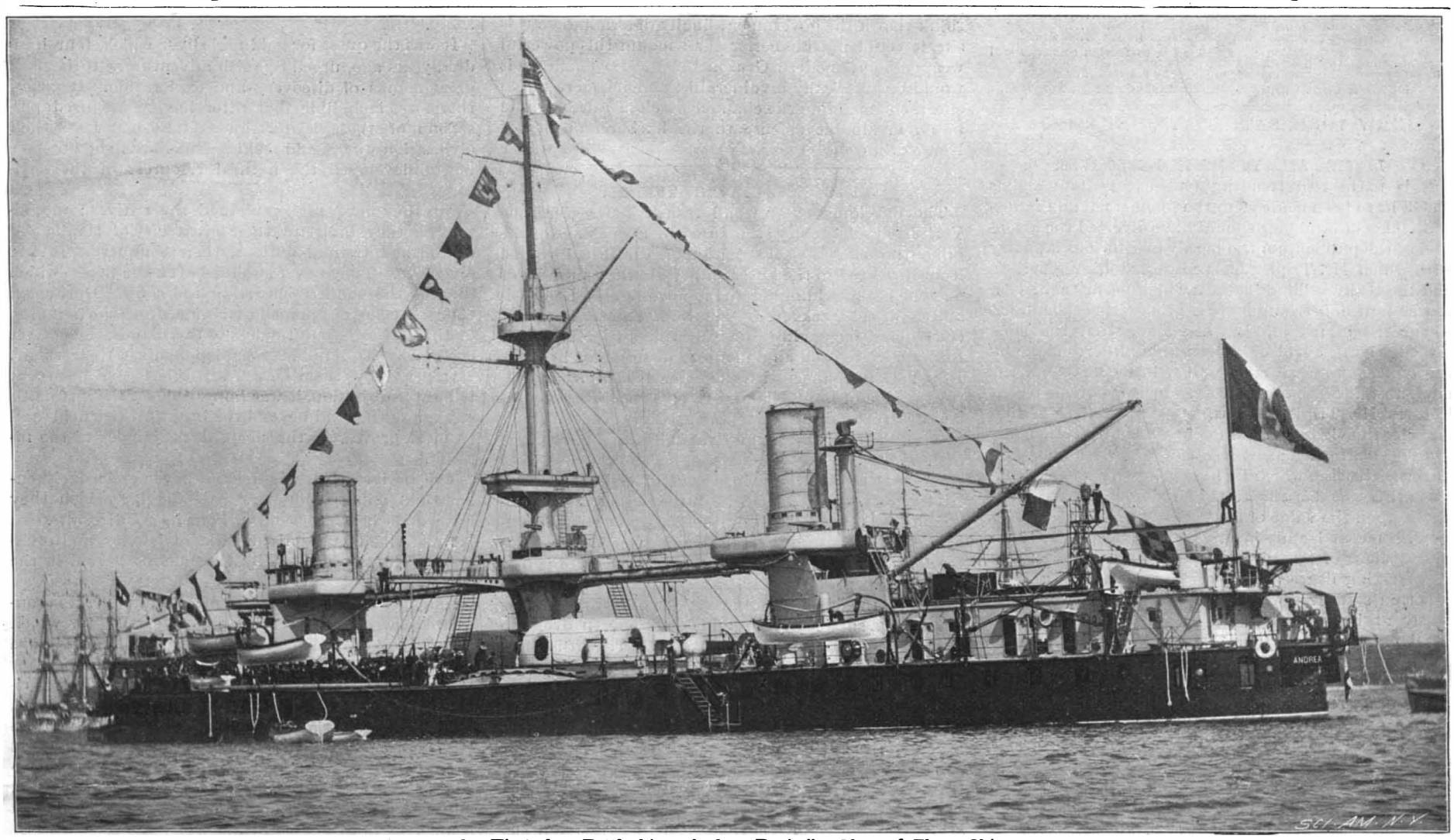
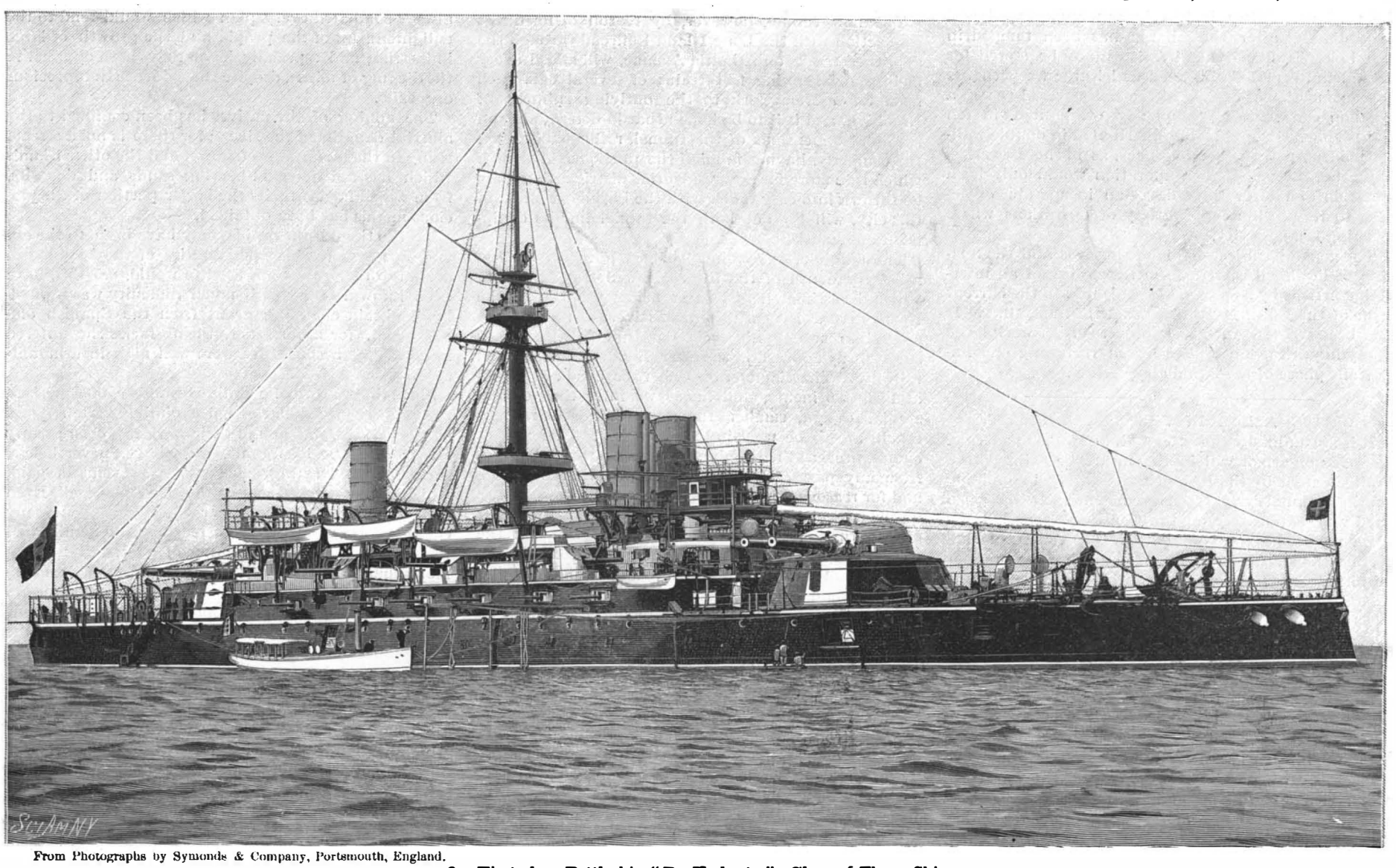


1.—First-class Battleship "Andrea Doria." Class of Three Ships.

Displacement, 11,000 tons. **Speed,** 16·1 knots. **Normal Coal Supply,** 850 tons. **Armor:** Partial belt, 17·7 inches; main gun positions, 17·7 inches; deck, 3 inches. **Armament,** four 17-inch 105-ton B. L. rifles, two 6-inch rifles, four 4·7-inch rapid-fire guns, two 2·9-inch, ten 2·2-inch, ten 1·4-inch rapid-fire guns, two machine guns. **Torpedo Tubes,** 5 (2 submerged). **Complement,** 500. **Date,** 1885.



From Photographs by Symonds & Company, Portsmouth, England.

2.—First-class Battleship "Re Umberto." Class of Three Ships.

Displacement, 13,825 tons. **Speed,** 19 knots. **Normal Coal Supply,** 1,200 tons. **Armor:** Partial belt, 4 inches; main gun positions, 14 inches; deck, 3 inches. **Armament,** four 13½-inch B. L. guns, eight 6-inch rapid-fire, sixteen 4·7-inch rapid-fire, fifteen 6-pounders fourteen 1-pounders, two field guns. **Torpedo Tubes,** 5. **Complement,** 785. **Date,** 1888.

NAVIES OF THE WORLD—VI. ITALY.—[See page 362.]

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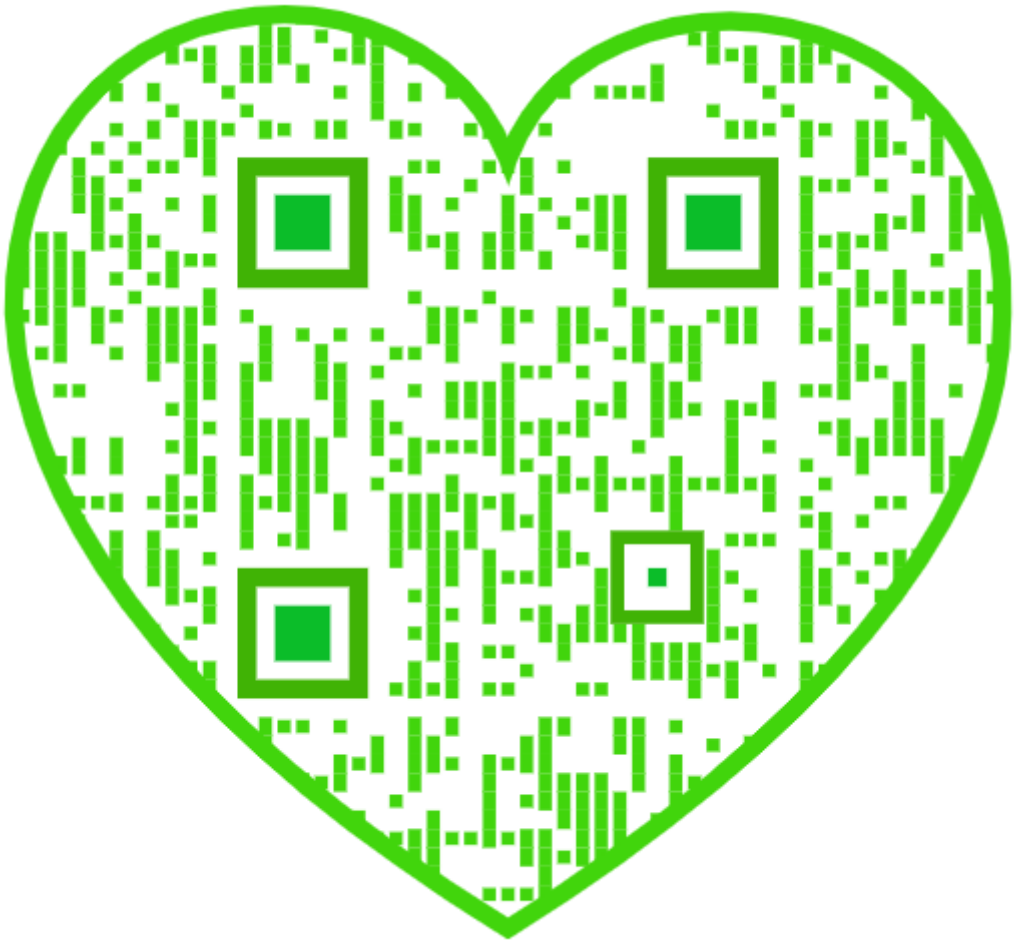

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LIQUID AIR IN HIGH EXPLOSIVES.

It is to be regretted that the extravagant claims which have been made as to the commercial and industrial value of liquid air should have diverted the attention of the public from the highly meritorious industry with which Mr. Tripler has prosecuted his researches, and the really brilliant success which he has achieved. It was no small triumph for a private experimentalist to succeed in making by the gallon what the most skilled scientists had only been able hitherto make by the ounce, and at a stroke to reduce the cost of the new substance a hundred fold. In some of his recent lectures Mr. Tripler has expressed himself as feeling hurt by the vigorous manner in which his statements have been attacked; but he should clearly understand that the criticism which he has evoked has been directed entirely at his theories, and does not throw any doubt upon the value of his work.

In his recent lecture in this city Mr. Tripler exhibited fragments of two pieces of pipe, which showed in a very striking degree the powerful explosive properties of cotton saturated with liquid air as demonstrated recently at his workshop. His assistant had placed a small portion of cotton, thus saturated, in a short length of 2-inch gas pipe, and to prevent the flying fragments from doing any damage, had inclosed the 2-inch within a 6-inch pipe. The liquid air cotton was exploded and the 2-inch pipe (which was not tamped in any way) was torn into small fragments which cut their way cleanly through the outer pipe, giving it a sieve-like appearance. The high explosive qualities here indicated have been proved by actual test in a European coal mine to be comparable in their effect to those of dynamite; but it is not likely that the new explosive will have any commercial value because its extreme volatility renders it imperative that the liquid air shall be used soon after it has been manufactured and immediately after the charge has been tamped in the hole. Unlike dynamite, it cannot be stored for an indefinite period and used at leisure; for with the present methods of transit in felt-covered cans, a 3-gallon can will be completely evaporated in ten hours' time. Even if it were distributed in double-walled holders, with a vacuum space, as in the Dewar receptacles, the complete evaporation would only be a question of two or three days—an insuperable objection to its use in a large variety of operations where blasting is a necessity.

The general subject of high explosives and the relation of liquid air thereto form the subject of an interesting article by a specialist in this line in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT. It has been written with the object of answering the many inquiries which have arisen regarding one important phase of the liquid air question.

GRUSON ARMOR IN THE UNITED STATES.

It is not unlikely that the well-known chilled cast-iron Gruson armor will in the future be utilized to a limited extent by the United States army in building up the national system of coast defense. It has been used very extensively on the Continent, especially by Germany and Italy, and for the protection of land fortifications it has been found to give results superior to forged steel. As compared with the latter, chilled armor is more massive, many of the plates ranging up to 36 inches in thickness and 50 to 60 tons in weight. For this reason it is never used on battleships; but for land fortifications, where an extra 100 tons or so of weight presents no inconvenience, it forms an ideal armor, being capable of use in masses of such form and weight as will easily defeat the attack of the heaviest artillery. The plates, whether they are to be built up into turrets or casemates, are cast in massive segments, with parabolic surfaces, and they are provided with deep tongues and grooves along their abutting edges by means of which they may be fitted together without the use of bolts or any system of screw fastenings.

The outer face of the plates is chilled to a depth of from two to three inches, and this intense hardness, coupled with the great dead weight and the impossibility of striking a direct blow upon the curved surfaces, renders a Gruson turret positively invulnerable. The German artillerists carried out a series of searching tests, placing shot after shot upon a turret, without being able to disturb its integrity. The system is of course costly, much more so than the earth and concrete protection behind which our coast defense guns are mounted; but there is no question that for a few of the more important and exposed positions, such as those at Sandy Hook or on Romer Shoals (which it is proposed to fortify), the Gruson armor would be found to well repay the cost of its installation. The long-standing proposition to erect the new 16-inch 125-ton gun on Romer Shoals is again to the front, and we think that if the government finally determines on this site it could not do better than mount this powerful weapon in a modern Gruson turret. So mounted it would be practically invulnerable, and its mere moral effect, commanding the channel at close range, would be an invaluable defense to the harbor and city of New York.

THE EAST RIVER TUNNEL.

The development of rapid transit in Greater New York has been greatly stimulated by the passage of the bill authorizing the construction of a railroad tunnel from Brooklyn to the lower end of Manhattan Island, and the bill providing for the removal of the Long Island Railroad tracks from Atlantic Avenue. The present schemes covered by these measures contemplate a through route from an underground terminus in lower New York to connect with the extensive suburban railroad system of Long Island. It is also proposed ultimately to extend the tunnel beneath the Hudson River to connect with the Pennsylvania Railroad terminus in Jersey City.

We have frequently pointed out in the SCIENTIFIC AMERICAN that the difficulties of the rapid transit problem in this city were due to peculiar topographical conditions. Manhattan Island is hemmed in on three sides by a wide stretch of water, which in every direction but one has prevented unbroken railroad communication with the outlying suburbs. The only direct means of exit by a suburban railroad is to the north over the lines of the New York Central system. True it is there is an excellent street car service and a more limited service of elevated cars running from New York to the outlying districts of Brooklyn; but it is not the kind of express service which alone is capable of carrying business men in reasonable time to and from their suburban homes. We doubt whether the new East River bridge will afford the necessary connection for a service of the kind desired, for, while it will form another valuable connection between the street and elevated railway systems of New York and Brooklyn, there has been no proposal to use it for the running of express suburban trains.

The new tunnel, however, by reason of its direct connection with the Long Island Railroad through the depressed tracks on Atlantic Avenue, will afford every facility for running fast trains of several cars each from lower New York to the outlying suburbs of Brooklyn, and it is to be hoped that in determining on the final dimensions of the tunnel, rolling stock, etc., the company, having in mind the phenomenal growth which is in store for any residential districts that may be thrown into easy touch with the business centers of this city, will lay out both the tunnel and its equipment on a most liberal scale.

The depth of the tunnel has been governed by the necessary depth of the future New Jersey extension, which is estimated at 30 feet below the bed of the North River. Beneath the East River the road will be carried in two separate circular tunnels, after plans successfully adopted in the later London underground railways. The diameter of each tube has been placed at 14 feet 6 inches, and hence we infer that cars of special design, smaller than the standard railway coach, are to be used in the tunnel. This would, of course, prevent the running of standard through trains from any part of Long Island to Manhattan Island, and for reasons stated above would indicate a failure on the part of the promoters to realize the possibilities of the tunnel. The difference in cost between the tunnel proposed and one of standard railroad dimensions would not be prohibitive, and would be handsomely repaid in its enlarged usefulness, especially when the New Jersey connection shall have been made.

THE PAN-AMERICAN EXPOSITION.

The Board of Directors of the Pan-American Exposition Company have agreed that the coming Exposition shall be located at the Rumsey Farm on the Niagara frontier in the northern suburbs of the city of Buffalo, and include a part of Delaware Park. Three experts including an architect and a landscape architect made the selection. The proximity of the Rumsey site to a beautiful park and its accessibility are all points in favor of this location. The approach is through some of the most attractive residental districts of the city, and the whole area is within four miles of the City Hall. Arrangements for preparing the site for the Exhibition purposes will be begun at once.

GOLD IN THE PHILIPPINES.

BY THE PHILIPPINE CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Whether or not a tropical El Dorado will be discovered in our newly-acquired Philippines the future alone can decide; but certain it is that much time and labor will be expended in seeking the gold which the islands are said to contain. Before the outbreak of hostilities, American prospectors had made many trips inland; but the attitude of the natives prevented any systematic exploration of the country. Meager though the information acquired may be, there can be but little doubt that, in the unknown interior of many of the islands and in Luzon in particular, gold lies buried away.

It was the quest for gold and silver which, four hundred years ago, urged Spanish adventurers to begin a great course of discovery and exploration. It seems, therefore, incredible that after having acquired possession of these islands and established here their civilization, these gold-seeking Spaniards should have left undeveloped the natural resources of the territory.

But they never really subdued the natives; and, although they built up their great city of Manila and established trading-stations, their conquest was not extensive. They never subdued even the tribes which inhabit the country bordering the coast. During all the long years of Spanish dominion, from the founding of the first colony to the loss of the islands, the natives constantly rose up in rebellion against their rulers. Hampered by their efforts to bring the insurgent tribes to subjection, it was impossible for the Spaniards to explore the land beyond the beautiful rice fields and tropical groves, in the deep, dark jungles of the interior.

The natives themselves have never extensively engaged in mining; but the little digging which they have done has not been without its good results. In Manila, much gold in the form of jewelry and ornaments skillfully worked by the natives is sold in the shops.

Among many of the tribes of the interior, it is considered sacrilegious to disturb the earth; for which reason they have themselves not dug for gold and have prevented others from so doing. During the last few months they have resisted the encroachment of American gold seekers, because, they said, they feared that the wrath of their gods would fall upon them, if the earth were made to yield its treasures. It may be that there are other reasons; for the natives, although superstitious, are crafty, and would naturally oppose the mining of the noble metals by any save their own people.

Still another reason may be advanced to explain the undeveloped condition of Philippine mineral resources. The friars, who wield so enormous an influence, have always combated every plan which would tend to the enlightenment of the people and the growth of large industries; and especially have they been opposed to the digging of mines, despite the evidence that precious ores exist.

The mining of the natives has been confined to the alluvial deposits of the rivers; for there is not a stream rising in the mountains of Luzon and the other islands which has not its gold-bearing sands and deposits, from which for centuries the larger portion of the precious metals has been obtained.

Hostile though the natives may have been to the advance of explorers, the possibilities of the islands under any other rule than Spain's would, ere this, have been known. Only with much difficulty was it possible to obtain a mining grant from the Spanish officials; and, for a foreigner, the obstacles encountered in obtaining a concession were well nigh insurmountable.

Since the capture of Manila a number of American prospecting parties have been exploring various parts of the islands. Although their work has been greatly retarded by the insurgents, they have, nevertheless, succeeded in locating some very rich veins of gold, which will be worked when peace is established. Even before the outbreak of our war with Spain, a company composed largely of Spanish residents of Manila had undertaken the alluvial mining of gold; but nothing more than the preliminary prospecting was ever accomplished. So promising is the outlook for the future that many of our soldiers, particularly those of our Western States, have expressed a desire to remain in the Philippines in order to engage in mining after the insurgents have been subdued.

Our prospectors have confined their explorations to Luzon; but even on this island, perhaps the most civilized of the entire Philippine group, are regions which have never been trodden by a white man. Some of the other islands, it is said, also contain gold, and on Mindanao it is certain there are valuable deposits. Old miners, who have been in Cripple Creek and in the Klondike, have already arrived in Manila, and form but the advance of an army of gold-seekers, which will invade the country when peace has been established. The present war cannot long continue, nor can it long delay the development of the mineral resources of our eastern possessions.

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SOME SMOKELESS POWDER CONSIDERATIONS.

BY FREDERICK H. M'GAHIE.

An interesting discussion relative to the merits of certain smokeless powders and processes is now in progress in the columns of the SCIENTIFIC AMERICAN and the SCIENTIFIC AMERICAN SUPPLEMENT. There are certain considerations that may escape the interested lay reader in forming an opinion, and yet they are of absolute importance in reaching correct conclusions. A bridge may be correctly designed and yet fail through bad workmanship in construction. Such was the case of the Ashtabula bridge some years ago, for expert engineers checked the calculations and plans after the accident and found them correct. A wrecked gun does not necessarily settle the fault upon a powder at once. Good judgment requires that such a conclusion must be reached through a process of elimination of other causes that have a possibility of existence. A smokeless powder must conform to certain general conditions such as chemical stability, mechanical stability, uniformity, absence of dangerous ingredients, convenience of loading, ability of being manufactured commercially. Yet a powder exhibiting a high degree of value in all these essential properties may be delivered by one company as a trustworthy article, and by another company as an equally dangerous explosive. The personal equation of the factory management and equipment determines the value of a powder. To state that a given formula and process is a commercial commodity is not equivalent to stating that any set of ignoramuses can "shove it out" satisfactorily. To manufacture a good smokeless powder requires a well designed factory, good materials, and a large enough corps of explosive engineers, thoroughly trained, practically and theoretically, who understand the limits bounding the production of a reliable powder. Those limits are known to the trained men, for the experience gained with the early smokeless powders and the investigations of conditions occurring in gunnery are at their command. Though cordite is held to be too erosive by the majority of ordnance and powder experts, the English government has an enormous amount on hand, and is satisfied by wide tests that it can be relied upon. Yet cordite has to its record several guns destroyed and many lots rejected as dangerous. Properly made within proper limits it appears to be safe for storage and use. Made outside of those limits it becomes so warped as to be dangerous. The early experience of the United States with brown prismatic powder consisted in rejecting more than it accepted. The Ordnance Department of the army finally detailed an officer to study the question, and he succeeded in putting the matter on another basis altogether.

A good illustration may be had from the meteoric career of the Leonard powder. In 1890 Dr. R.C. Schüpphaus brought out a first-class nitroglycerin powder, the demand being at that time for the ballistics possible with such powders. The nitrocellulose he adopted was one determined after long investigation of many varieties to be the best adapted for incorporation with nitroglycerin. The safe proportion of that explosive he placed after another series of experiments at 60 per cent. Being ahead of the times he retired until 1893, when he and Hudson Maxim grappled with the problem of a gun-cotton powder with the ballistics of nitroglycerin powders. Meanwhile an assistant in that early work who had picked up some crude ideas of the subject helped to launch the powder in question upon its erratic course. Using a very poor nitrocellulose for the purpose, the nitroglycerin was increased to 75 per cent on the general idea that too much could not be had of a good thing; of course the powder (?) "sweated" and the men susceptible to nitroglycerin effects at the proving grounds developed big headaches. Storage in winter brought out the ugly "nature of the beast." At Sandy Hook, samples gave spectacular exhibitions of ballistic variations. A charge giving 24,000 pounds one month gave 40,000 pounds the next. The navy lost an 8-inch rifle through similar circumstances. While samples of good nitroglycerin powders keep in excellent condition, I have seen Leonard powder of 1894 crumble away between the fingers in 1897. But we cannot condemn nitroglycerin as an ingredient for powders upon these experiences, although the navy experts gave it an undue prominence in fixing their attitude upon the matter. The trained explosive engineer would have thrown the powder out of consideration at once upon the grounds of its formula. The known limits had been clearly exceeded and dangerous qualities were to be naturally expected. Again, those early samples, such as were shown at the World's Fair, exhibited careless manufacture, many lumps of unconverted nitrocellulose being apparent in the individual grains. When the Russian government destroyed a lot of cordite it had purchased, what was proved was that the lot had been badly made, since satisfactory orders of magnitude have been delivered since.

If I may venture the opinion, the average American powder manufacturer does not pay enough attention to this personal factor. Machines are more reliable than men only when a high intelligence is connecting and limiting them. The so-called "practical" man must give way to the trained experts in chemistry, machinery, manufacture, and mathematics, before the era of first-class powders is ushered in. A good formula and process are not going to run themselves in desired directions, while superintendents are ignorant or more concerned with quantity than with quality. Yet it must be confessed that Congress and the departments do not aid matters any. The one is averse to encouraging ideas, the other is backward in necessary appropriations, and the inventor generally gets disheartened between the two.

There is generally plenty of money for making mud holes navigable, or for other philanthrophic propositions for constituents, but a plan to catch up within a few years of Europe brings out patriotic denunciations of our infidelity in not relying upon God to keep our powder dry and win our battles.

With the official board's new ideas arose the frigidity of atmosphere that makes liquid air a luxury. A man who has had extensive dealings with the government stated the case as follows: "Do not try to educate the government if you desire to declare dividends. Sell them what they think they want. If they wish to call red sand smokeless powder, furnish it if you see a profit in it." And the trouble is that the government, willing to give a $500 politician a $2,500 position, is continually haggling on prices for articles in regard to which the question should be quality, and not price. This puts a stress upon manufacturers to cut prices when they should not, and cover it by questionable economies, or forcing the output.

The smokeless powder business is no Klondike, for accidents are costly, business variable, and new things liable to make a plant archaic. One company is said to have dropped $200,000 in explosives during the last three or four years. Liberality—to please Congress in our phrases—should be the order of the day to secure the means of offense and defense, upon whose quality millions will depend in the future.

THE PLANT PRODUCTS OF THE PHILIPPINE ISLANDS.

The Department of Agriculture has recently issued a report on the plant products of the Philippine Islands, which is particularly interesting at the present time. The report deals with the agricultural resources of the islands as they now exist, and shows that although an agricultural country, the islands do not produce enough food for the consumption of the inhabitants. In order to supply the deficiency, it is the custom to draw upon rice-producing countries, such as Cochin China. About one-ninth of the area of the Philippine Islands, or 8,000,000 acres, is devoted to agriculture. When the natural fertility of the soil is considered and the large amount of the rich land not yet cultivated, it can be assumed that with better agricultural methods the products of the islands could be increased ten-fold. Rice forms one of the most important food products of the islands; more than a hundred varieties are grown; the annual production is about 36,000,000 bushels. This is, of course, far below the actual requirements of the population, even when supplemented by other vegetables and fruits. Maize, next to rice, is one of the most important of the grain products of the Philippines, and the sweet potato follows maize in turn. Fruits grow in great abundance, bananas heading the list. Large quantities of sugar cane are grown, but owing to crude methods of manufacturing, the sugar is inferior in quality, and is sold for a low price. Cotton is not as valuable a product for the islands as it was once, owing to the successful competition of British fabrics. Formerly indigo was also one of the important products of the islands. Coffee plantations thrive well, but the coffee is not of the best quality and the plantations are not well managed. In most of the islands of the archipelago tobacco is grown, and over one hundred million cigars are annually exported from Manila, and the shipment of leaf tobacco averages about 20,400,000 pounds. The islands also furnish spices and the medicinal plants are abundant, but most of them are little known.

PHOTOGRAPHY OF PAINTINGS AND DRAWINGS.

At a lecture given before the Photo Club of Paris, M. Sanger Sheperd brought out the results of his experiments as to the best method of photographing paintings, drawings, manuscripts, etc. In the case of paintings, he dwells upon the importance of having the picture lighted in the proper manner.

For pictures in which the tints are delicate, such as water colors, he recommends exposure by diffused daylight, but for those whose color is somber, such as that of old pictures or oil paintings, he prefers exposure in the open air as being more suitable, for in this way details in the shadows are obtained which it is impossible to have otherwise.

If artificial light is used, the sources of light should be placed to the right and left, and rather near the picture.

If they are too far off, and too near the camera, disagreeable reflections are produced.

In the reproductions of drawings, writing, or printed matter, the lecturer recommended the use of a blue screen, and a small diaphragm. The focus must be carefully made, a full exposure being given, and once the negative is fixed, it should be plunged for several seconds into a bath of reducing liquid (hypo and red prussiate of potash), in order to obtain complete transparence in the whites of the negative.

As to the method of development, it is found that hydroquinone and kindred developers bring out first the blues, then the greens, and lastly the reds. However, as the development of a negative with these substances requires from 10 to 30 minutes, it is to be feared that the reds will not be produced. On the contrary, metol and other similar developers cause the whole of the image to appear at the same time, and proper density may always be obtained by prolonging the development.

THE "REINA MERCEDES."

With the arrival of the protected cruiser "Reina Mercedes" at an American port, the navy secures at once a useful addition to its fighting strength, and the most valuable trophy of the war. When the ill-fated "Maria Teresa" was floated and started for the United States, it looked as though we would secure at least one of the big 7,000-ton armored cruisers of the Spanish navy, which, under a new flag but retaining its old name, would perpetuate the brilliant victory in Cuban waters. But that was not to be, and for awhile it looked as though the many small gunboats and launches captured in the Philippines and a few that were secured in the West Indies would afford us no naval trophy of the war much over a thousand tons in displacement.

The "Reina Mercedes," however, is a very serviceable vessel of 3090 tons displacement, or a little less than the "Raleigh," her trial speed also being about 1½ knots less, or 17½ knots an hour. She was built at Carthagena, in 1887, or three years later than the "Atlanta" and "Boston," and was one of the ships of the earlier period of the reconstruction of the Spanish navy, when the design and building of Spanish vessels was largely carried out by British naval architects. Presumably, therefore, she is a well-built ship and capable, after overhauling and re-arming, of being made into a serviceable modern cruiser of the protected type. Her original armament consisted of six 6·2 inch Hontoria guns; two 2·7-inch, three 2·2-inch, two 1·5-inch and six 1·4-inch rapid-fire guns, with two machine guns. She was fitted with no less than five torpedo tubes, and as all of these are above water they will probably be closed up, the above-water discharges being now considered as constituting a greater danger to the ship that carries them than to the enemy.

The new armament will consist of six 6-inch American guns of the new long caliber, smokeless powder pattern, and the miscellaneous sizes at present in the secondary battery will be replaced by our standard 6-pounder and 1-pounder rapid-fire guns. The new navy 6-inch gun will be a more powerful weapon than the old 6·2 inch Hontoria weapons; and that the latter were destructive was shown by the havoc wrought by a shell from one of these weapons which was fired from the Socapa battery and entered the forward battery of the "Texas," putting it out of action for the time being. Those who wish to see what such a shell can do will find illustrations of the damaged plates in the SCIENTIFIC AMERICAN of August 20, 1898.

It so happens that the comparatively slow speed, 17·5 knots, of the "Reina Mercedes," her size and battery, will render her practically a sister ship to the half dozen cruisers authorized by the last Congress. These ships are to be of 3,100 tons displacement and 16·5 knots speed. They are to carry an armament of ten 5-inch rapid-fire guns, and will have a trial coal capacity of 470 tons. The coal capacity of the "Reina Mercedes" is 600 tons. Allowing for depreciation of her machinery, it will be seen that her speed is about the same and her coal capacity greater than the new cruisers, thus rendering her admirably adapted to the particular class of service for which they have been designed.

COMMERCIAL PRODUCTION OF LIQUID AIR.

The General Liquid Air and Refrigerating Company, of New York, has been for several months erecting a plant in New York city, which is now practically complete. The apparatus is upon a scale suitable to be operated by a steam engine of 200 horse power. The liquefying apparatus is the invention of Messrs. Ostergren and Burger, the engineers of the company. The first experimental run was made on May 25 and resulted in complete success. The liquid air is said to have poured from the discharge pipe at a rate which indicated the easy production of one gallon a minute at full load. This quantity is the amount which the inventors had predicted in advance as the output of the machine. During the experimental run the average pressure maintained in the compressor was 800 pounds, while at full load the pressure to be carried is 2,000 pounds. When the success of the plant was evident, the men employed in the factory went wild with enthusiasm, took Mr. Ostergren upon their shoulders and carried him around the works in triumph. We expect to present to our readers in an early issue a full and illustrated account of the plant, with details of the process employed.

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POCKET VOLTMETER AND AN ELECTRIC SOLDERING IRON.

A handy pocket voltmeter in the form of a watch is one of the instruments exhibited by the Whitney Electrical Instrument Company, at the Electrical Exhibition. This meter has a five-volt scale divided to fifths of a volt, and below it, on some instruments, a milliampere scale also. It is designed for storage battery work principally and for all similar work in which low potential and small current readings and tests are made. Inside the case, as will be seen from our illustration, is a circular magnet which holds the needle at

A WATCH VOLTMETER.

zero by keeping the magnetic bar on its lower end in a horizontal position. When the current passes through the solenoid, this short bar is moved through an arc and moves the needle with it. A piece of soft iron is placed in the top part of the solenoid for the purpose of attracting the magnetic bar more strongly, for if this were not done the dimensions of the scale would have to be uneven at the end. The meter will commend itself to all because of its compactness.

Another convenient article at the Electrical Exhibition is an electrically heated soldering iron intended for soldering wire, electrical connections and other articles. Between the handle and the soldering copper point is located a coil of German silver wire in sufficient quantity to give out the required heat for soft solder in a very short time. The current is taken from an ordinary lamp socket through flexible lamp cord, and only a trifle more is required to heat the coil than is necessary for a 16 candle power incandescent lamp.

The electrical soldering iron is now preferred by electricians in their work on account of the uniform heat obtained, and we are informed it is now in general use. This iron is only one of many other interesting applications of electricity for heating purposes shown by the American Electric Heating Company at the east end of Madison Square Garden Hall.

An Intelligent Fish.

M. Semon in his recent voyages has observed an interesting fact which shows the large development of the memory and faculty of observation of a certain fish called the Echeineis remora. It is known that this fish is provided with a kind of sucker on top of its head, which it uses in order to attach itself to hulls of vessels, the shells of tortoises, and even to fish larger than itself, such as the shark. One day, during a voyage near Australia, M. Semon having cooked some crabs of a very savory odor, the remains of the repast were thrown overboard. Each fragment as it fell was seized by a fish about 9 or 10 inches long. M. Semon recognized the echeineis, and wished to procure a specimen. The first fragment of crab which he threw into the water was baited to a hook and line, and a specimen was caught at once. The line was again thrown, under the same condition, but not a single echeineis would touch it, nor even fragments not so attached. During the whole day the fish declined to eat anything that was thrown to them. Evidently they had seen one of their comrades disappear and became distrustful on this account; thus they remained attached to the bottom of the vessel without allowing themselves to be tempted. This same observation was repeated on different occasions. M. Semon could easily take one specimen of echeineis, but never two of the same band in the same day. These fish have evidently a power of observation and a memory not possessed by most of their kind, as every one knows that at the same spot one may catch any quantity of fish of the same kind, who nevertheless see their companions disappear in a mysterious manner. As to the habit which the echeineis have of fixing themselves to the hulls of vessels, M. Semon explains this by supposing that these fish live upon the debris of food and other waste matters of the ship.

Consumption of Rice in France.

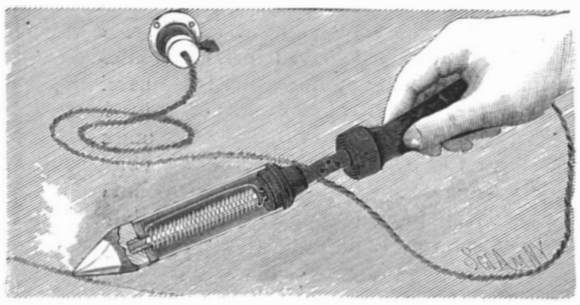
M. Maurel has communicated to the Congrès des Sociétés Savantes the results of his observations upon the consumption of rice in France, and shows that from 1875 to 1895 this has increased from 34,000,000 to 68,000,000 of kilos. He had studied the causes and consequences of this, especially from the point of view of hygiene, but also as to the commercial interests of the country. The importation of rice from 1875 to 1895 has increased from 2,500,000 to 65,000,000 of kilos, and the price has fallen so that rice flour now costs appreciably less than wheat flour. He shows that rice occupies a high place as a food, and that its calorific properties are the same as those of wheat, 100 grammes of wheat giving 350 calories, and 100 of rice giving 353 There would thus be no disadvantage if the latter were more generally adopted as an aliment, thus replacing wheat.

As to the question of commercial interests M. Maurel shows the advantages which would result by replacing the wheat imported from foreign countries by rice from the French colonies. He shows also that rice flour may be mixed with that of wheat up to the proportion of 6 per cent without detriment to the bread thus produced, and without diminishing its nutritive properties.

AN ICEBERG AT ST. JOHN'S, NEWFOUNDLAND.

It is not unusual at the proper season of the year for vessels to sight icebergs while making the Trans-Atlantic passage, specially if the vessels happen to be taking a northerly course, but it is seldom that an iceberg grounds so that it can be seen by those on shore. This was recently the case at St. John's, Newfoundland, where an enormous iceberg, 150 feet high and nearly a quarter of a mile long, grounded off the south-side entrance to the harbor, where it was, of course, seen by many thousands of spectators.

Most icebergs are produced from glaciers which move down from elevated heights in the interior of some land in the Arctic regions. The glaciers move slowly onward into the deep waters of the sea, and from time to time fragments break off from the advance border and float away, forming icebergs. Occasionally whole masses of ice break off at once, really forming floating islands. Ice islands are also made by the breaking up of the great fields of ice of the Arctic region. In the Atlantic Ocean most of the icebergs come from Greenland and Iceland, the greatest numbers being produced on the west side of Greenland. From Labrador the ice is floated with the current past Newfoundland, and keeping near the Great Bank the warming influences of the Gulf Stream cause it to disappear. Usually the limit of travel of icebergs is 40 degrees north latitude, but in the South Atlantic Ocean they have been found as near as 37 degrees south latitude. Naturally these immense masses of ice are a serious peril to navigation as when the "Arizona" smashed her bow on an iceberg off the coast of Newfoundland on November 7, 1879, and they frequently lodge on the banks of Newfoundland, much to the discomfort and danger of navigators. Nothing is more imposing than the sight of one of these immense icebergs, which might send the finest ocean steamship to the bottom in a few moments. The iceberg is apt to be of an intense bluish white; they are real floating mountains of ice. The sun melts them unevenly, causing rugged and picturesque peaks to jut into the air, and in northern latitudes, where whole fields of



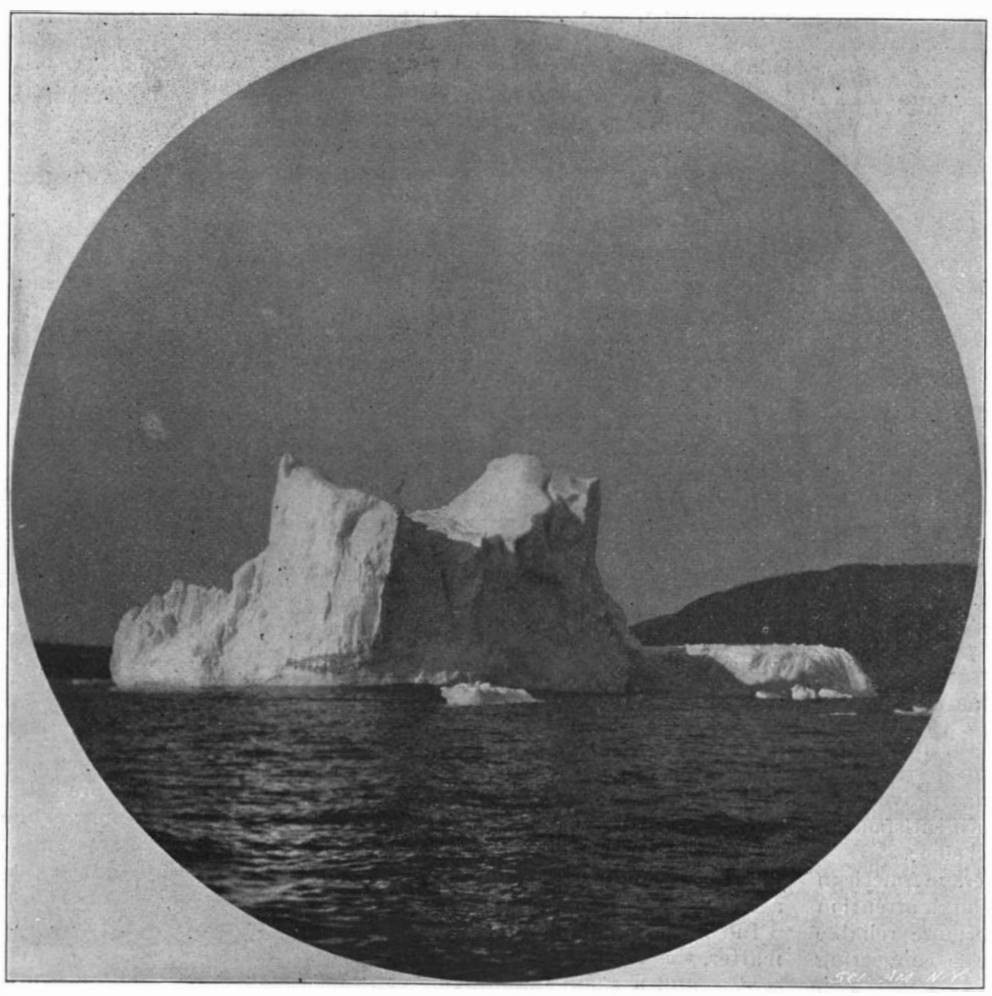
AN ELECTRICALLY HEATED SOLDERING IRON.

icebergs are seen, they look like fairy castles. Dr. Kane in his first cruise counted 280 icebergs in sight at one time, and most of these were over 250 feet high. It is, of course, a well-known fact that about one-eighth or one-ninth of the berg projects above water. As might be imagined, the iceberg, containing as it does at its base many pieces of rock carried down by the glacier from some northern country, scores the bottom of the sea, acting really like a gigantic file. When the enormous bulk of the iceberg is considered, it will be seen that the current hurrying it along might cause the iceberg to produce considerable change in the floor of the sea over which the iceberg passes, and geologists recognize in this operation a repetition of the phenomena accompanying the distribution of the drift formation and the production of rounded bowlders, gravel and sand.

Parade of Automobiles.

A parade of automobile vehicles took place in New York on May 24. The route was from Madison Square Garden, by way of Madison Avenue, Fifth Avenue, Lenox Avenue, Morningside Avenue, and Amsterdam Avenue to Columbia University. The parade started from Madison Square Garden at 3:30 P. M. and ended at the University at 4:30 P. M.

The parade was led by Col. A. A. Pope, driving his Columbia Stanhope, then followed Mr. Riker, in his Stanhope, followed by a large number of automobile vehicles. There was considerable dissatisfaction over the fact that the automobiles were not allowed in the Park. The time will doubtless come when automobiles will have equal rights with carriages drawn by horses. The parade was considered a very satisfactory one, and was witnessed by a large number of spectators.



A STRANDED ICEBERG AT ST. JOHN'S, NEWFOUNDLAND.

An American Bridge for Japan.

The Phœnix Bridge Company has received a contract to build a large steel bridge for the Imperial Railway of Japan. The bridge will be in six spans and will be one of the largest steel bridges ever contracted for by American builders. As soon as the plans are completed work will be begun, and the bridge will be ready for shipping by September 1.

The Paris-Bordeaux Automobile Race.

The automobile race from Paris to Bordeaux, a distance of 353 miles, was won by a carriage called "The Petroleum Duke," the running time being eleven hours forty-three minutes and twenty seconds, or at the rate of twenty miles an hour, which is a very remarkable speed for so long a distance. The carriage had four seats and the engine was of four horse power. There were twenty-eight competitors in the race, and an occupant of one of the carriages jumped off while it was in motion and received fatal injuries.

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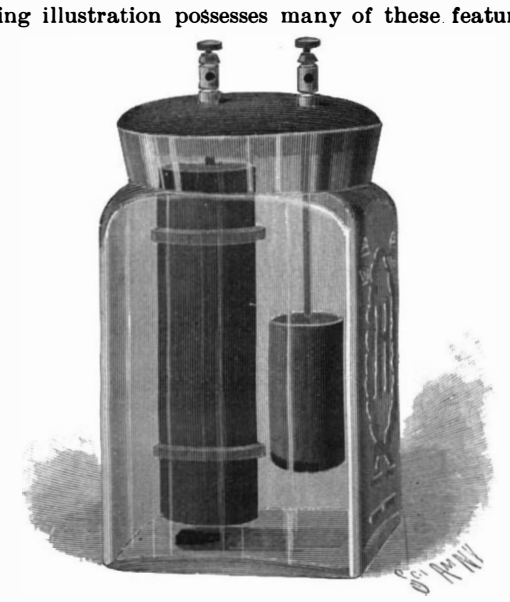
A POWERFUL OPEN CIRCUIT BATTERY CELL.

The value of primary batteries designed for open circuit work depends upon their freedom from local action, a minimum of internal resistance, quick recovery from an accidental short circuit and non-deterioration by evaporation. The Harrison cell shown in the accompanying illustration possesses many of these features



A POWERFUL OPEN CIRCUIT BATTERY CELL.

besides having a high electromotive force and a larger current discharge in proportion to its size than is usual in other open circuit batteries. It is quite simple in construction, requires very little care, and operates quickly after it is set up. The glass jar is about 3 inches square by 5 inches high and has a bell-shaped mouth paraffined, on which sits a wood cover holding the elements in suspension below. Cast in the jar is a line for water indicated by a "W" and another line above marked "A" for acid, making a very convenient guide for filling. The exciting fluid is sulphuric acid of 66° Baumé. The elements consist of a cylinder of peroxide of lead about an inch in diameter encircled by rubber bands and a cylindrical short zinc bar of the same diameter, 2 inches long, amalgamated with mercury to protect it from the acid. The rubber band on the lead element prevents the zinc from coming in contact therewith in case the rod supporting the zinc becomes loose.

In setting up the battery the acid is added to the water and the whole allowed to stand until the solution is cool, then the elements are immersed in the solution and the battery is ready to operate. Convenient binding posts are on the cover for connecting the cell to the line or to other cells in series.

Four of these cells have been in use in our office on our open call bell circuit for several months, requiring little or no attention, and have given good satisfaction.

When exhausted, the zinc becomes spongy and soft and the strength of current diminishes, but the battery can be quickly renewed by putting in a fresh zinc and fresh acid. Each cell is rated to give 2·45 volts and 40 ampere hours, so that the electrical energy produced costs but little over one cent per watt hour, making it a very economical battery.

The small size of the cell, its cheapness, its remarkable recuperative power and high voltage, adapt it to the open circuits of burglar alarms, telephone transmitters, electric bells, and to the operation of dentists' and physicians' outfits.

The cell is manufactured by Harrison Brothers & Company, Philadelphia, Pa., who are introducing it through the Thermo-Electric Company, 103 Times Building, Park Row, New York, from whom additional information may be obtained.

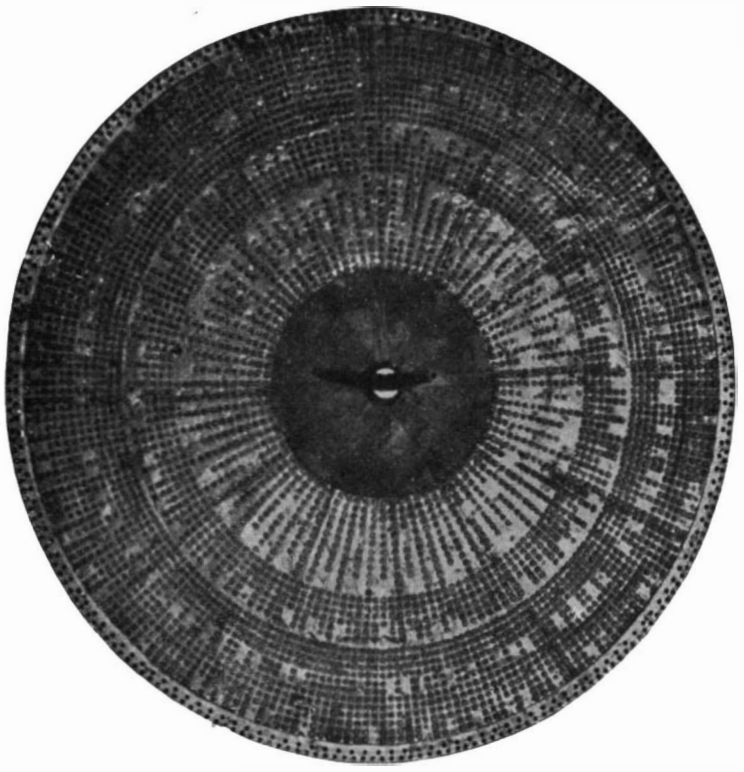
A CHINESE TYPEWRITER.

Some little time ago we referred to the various typewriters of the world, and stated that, up to the present time, no machine had ever been invented for use with the Chinese language. We are now informed, however, that the Rev. D. Z. Sheffield, of the American Board Mission, President of the T'ung-cho College, for Chinese students, has invented and perfected a remarkable typewriter, which bids fair to revolutionize the writing of Chinese, specially for foreigners, who have in most cases turned their whole attention to the speaking and reading of the language, and have avoided the great difficulty of learning to write it.

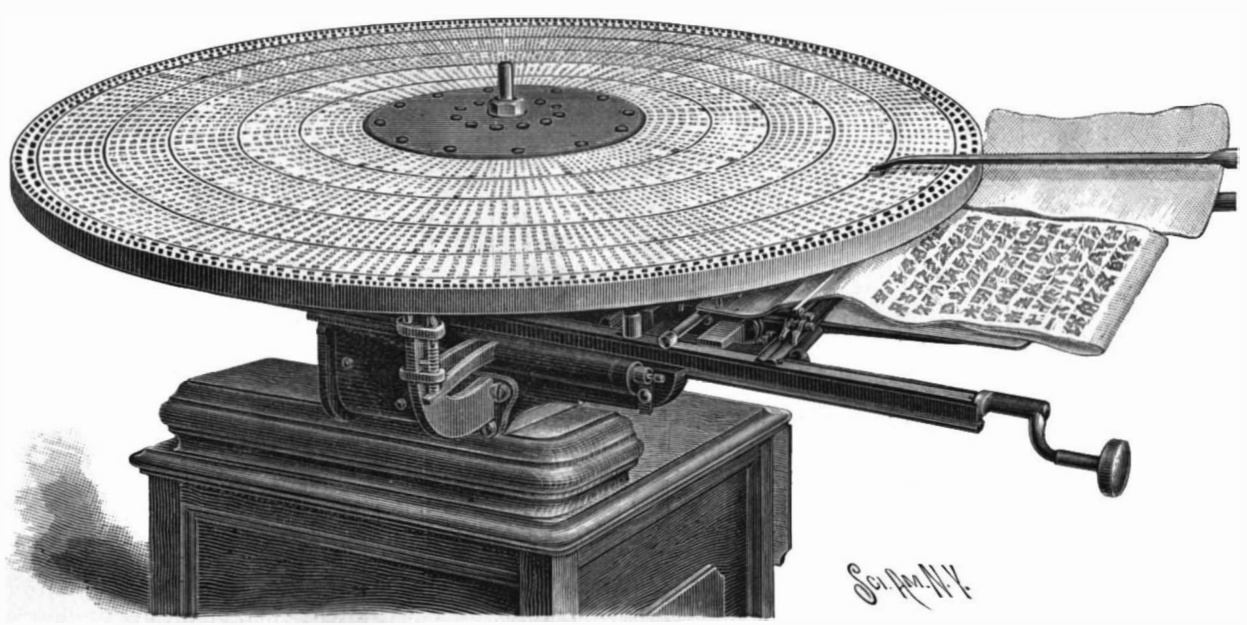
The Chinese language consists of at least fifty thousand characters, and a careful analysis of the classical works, as well as of the spoken language, has shown that not more than five thousand are in general use, while four thousand are ample for almost every purpose. The typewriter which Dr. Sheffield invented writes this number, and naturally the machine has required great labor in order to perfect it.

Through the kindness of Mr. Charles F. Gammon, of the Imperial Tientsin University, Tientsin, China, we are enabled to present an illustration of this remarkable machine. The four thousand characters are grouped in alphabetical order according to their accepted spelling in English, a large number of those most commonly used being placed in a separate group regardless of spelling. The type are cast on the under part of the large wheel, the upper side of which is covered with printed characters, each one exactly over the type it represents. The carriage moves freely to the right or left, and projecting from it there is a pointer which is used to locate the characters to be printed. In operation the wheel is revolved with the left hand until the group or line in which the desired character to be found is opposite the carriage, and the carriage is then moved with the right hand to the right or left until the pointer covers the character sought for. To the right will be seen a little crank, one turn of which inks the type, while a small hammer forces the paper against the type, leaving a clear impression. The type wheel locks during the printing and is automatically corrected if slightly out of place, the characters being brought into perfect alignment. The mechanism performs the operation of spacing, etc., as in other machines.

At first thought it would seem that even with this machine the writing of Chinese would be slow and tedious, but when it is considered that the written character consists of from two to twenty-five strokes, which even the best Chinese scholar writes slowly, as they handle the brush delicately, and that a character signifies, not a letter, but a whole word, it will be readily seen that Dr. Sheffield's machine saves a great amount of both time and labor, while it offers the advantages of other machines, namely, uniformity, accuracy, exact spacing and neat work. Our second engraving shows the under or type side of the wheel after it is removed from the machine, and in addition to the multitude of characters shows the holes around the circumference into which the locking pin goes during the operation of printing. Dr. Sheffield's typewriter is a triumph of American inventive skill.



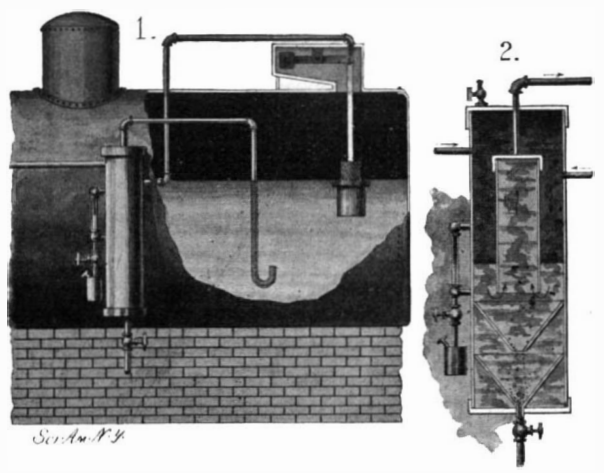
TYPE WHEEL FOR 4000-CHARACTER TYPEWRITER.



A TYPEWRITER FOR WRITING 4,000 CHINESE CHARACTERS.

A FEED-WATER PURIFIER AND SKIMMER FOR BOILERS.

By means of a simple device which has been invented by Herman W. Nye, of Elmwood, Neb., the feed-water



A FEED-WATER PURIFIER AND SKIMMER FOR BOILERS.

can be purified before entering a boiler, an apparatus being also provided which is designed to remove the foreign matter floating on the surface of the water in the boiler.

Of our illustrations, Fig. 1 is a sectional side elevation of the improvement as applied. Fig. 2 is a section of the purifier.

To the side of the boiler is attached a vessel which receives the feed-water to be purified, and which is filled with water and oil. Within the vessel a tube is fitted extending with its lower open end into the water. From the closed upper end of the tube a pipe leads to the boiler. In the bottom of the vessel two funnels are mounted, one above the other, the lower funnel being provided with a valved pipe, wherethrough the sediment collected can be removed. The feed-water as it enters the vessel flows down through the stratum of oil, whereby the impurities are removed, enters the lower end of the tube, and passes purified to the boiler, through the pipe connected with the closed upper end of the tube.

Into the upper end of the purifying vessel there also discharges a pipe, the other end of which passes into the boiler below the level of the water. This end of the pipe extends within a float or skimmer consisting of a cup which has a perforated or reticulated upper end, and which is counterbalanced to rise and fall with the water. The apparatus is designed to conduct the upper layer of the water in the boiler back to the purifying vessel, where its impurities are removed, before it is returned to the water compartment.

American Locomotives for the East.

The Baldwin Locomotive Works, of Philadelphia, have just secured the contract for the first locomotive for use in the development of the section of Palestine which is associated with the "Zionist" movement, and the Great Central Railway, of England, has placed an order with the same firm for twenty freight locomotives of the same character and design as those intended for the Midland Railway, of England, and which we have already illustrated.

Howell Gun Carriage.

The gun carriage designed by Rear-Admiral Howell, for which Congress appropriated $50,000, has been disapproved of by Gen. A. R. Buffington, Chief of Ordnance. He gives several reasons for his action. The gun carriage is designed to be used with the large seacoast guns of calibers from 8 to 12 inches. It is much larger and heavier than the Buffington-Crozier carriage now in use and has three hydraulic cylinders as compared with two in the latter design.

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PHOTOGRAPHY IN THE COLORS OF NATURE.

Photography in natural colors has again been going the round of the newspapers, this time from the West, but, like the cry of "wolf," it has so often been a false alarm, that it has received but scant attention; although, this time, there really is something, and something very important, in it.

Prof. R. W. Wood, of Wisconsin University, is the inventor of the method, which, briefly stated, is the production of a positive on which there is neither pigment, colored lines, nor color in any form; and yet when examined through an ordinary double convex lens it is seen in all the colors of the original, and, if possible, in colors more brilliant than those of nature's own. Nor is that all. Even more surprising is the fact that from that positive there may be printed by simple contact, and as simply as are printed lantern slides, as many copies as may be desired, every-one of which will show the colors in the same way and with the same brilliance.

Diffraction photography, according to Prof. Wood, in the Philosophical Magazine for April, is founded on the fact that if a diffraction grating of moderate dispersion and a lens be placed in a beam of light from a linear surface, and the eye placed in anyone of the spectra formed to the right and left of the image, the entire surface of the grating will appear illuminated with colored light, the color depending on the part of the spectrum in which the eye is placed. If one part of the grating has a different spacing from the rest, the spectrum formed by this part will be displaced relatively to the first, and if the eye be placed on the overlapping parts of the two spectra, the corresponding parts of the grating will appear illuminated in different colors.

If, then, three gratings are taken, of such spacing that the deviation of the red of the first is the same as that of the green of the second and blue of the third, and mounted side by side in front of a lens, their spectra will overlap, and an eye placed in the proper position will see the first grating red, the second green, and the third blue. If the first and second overlap, yellow will appear, and if all three, white light will be the result.

On this foundation, which perhaps only the initiated can fully understand, Prof. Wood has planned his method, not yet perfect, of course, but one that, in our opinion, will before long lead to the sale in every fancy store in this and other lands of pictures that, when seen in the little instrument that will go along with them, shall appear in all the colors of nature; and that both instrument and say a dozen of pictures will cost less than a dollar.

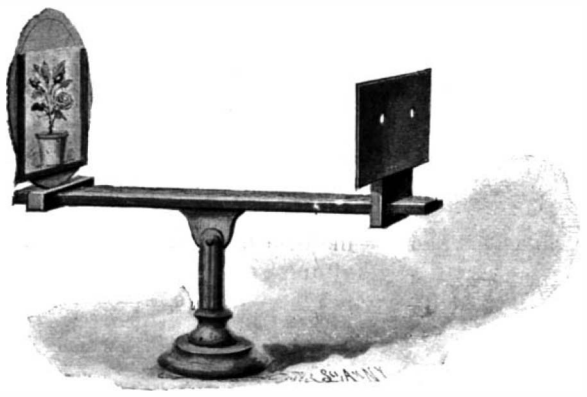
The first step in the production of a diffraction photograph is to make three negatives through red, green, and blue glass in the ordinary way, and from them to print positives on albumen transparency plates, albumen rather than gelatine, as the latter would soften in the warm water of the next operation. Prof. Wood employs albumen lantern slide plates. Those positives, when dry, are coated with bichromated gelatine and printed, each under a suitably spaced grating, and washed in warm water till the bichromate and unacted-on gelatine are washed away. Such positives, when examined by reflected light, and with the eye in the suitable position, show, respectively, the red, green, or blue of the object photographed and only need to be superimposed to show it in all its colors and shades combined.

And it is here that the most surprising part of the process comes in, so surprising, indeed, that the professor says, "It is almost incredible." A bichromated gelatine plate is printed successively under all three positives, washed in warm water as before, and dried; and although the gratings may contain some 2,000 lines to the inch, and to the lay mind must seem simply a confused mass, each does its own peculiar work, sends its own color to the eye and mixes them as they go, so that a bouquet of nature's own most brilliant painting appears in all its glory.

Not less wonderful is the fact that in this stereotype plate as we may call it we have the means of making it multiply itself by the thousand; all that is necessary being to employ it as an ordinary negative, from which as many copies may be printed as we desire and on bichromated gelatine plates.

It has been said that the eye must be in "a suitable position." To find that at a glance, Prof. Wood has devised a simple instrument that will answer the purpose admirably. It is essentially a cheap bi-convex lens, mounted in a frame to secure its correct position in relation to the picture, and need not cost as much as the cheapest of cheap stereoscopes. The cut will explain itself.

One serious obstacle to the prosecution of this kind of work is the great cost of gratings large enough for the purpose; but that the professor gets over in a simple and apparently an efficient way, as will be seen from his description of his method of enlarging up to any reasonable extent. He says: "The original grating ruled on glass was mounted against a rectangular aperture in a vertical screen, the lines of the grating being horizontal. Immediately below this was placed a long piece of heavy plate glass, supported on a slab of slate to avoid possible flexure. A strip of glass, a little wider than the grating, sensitized with bichromated gelatine, was placed in contact with the lines of the grating, and held in position by a brass spring. The lower edge of the strip rested upon the glass plate, so that it could be advanced parallel to the lines of the grating, and successive impressions taken by means of light coming through the rectangular aperture. In this way I secure a long narrow grating, and by mounting this against a vertical rectangular aperture, and advancing a second sensitized plate across it in precisely the same manner, I obtained a square grating of twenty-five times the area of the original. It was in this manner that I prepared the grating used to print the impressions on the three positives. So well did they perform, that it seemed as if it might be possible in this way to build up satisfactory gratings of

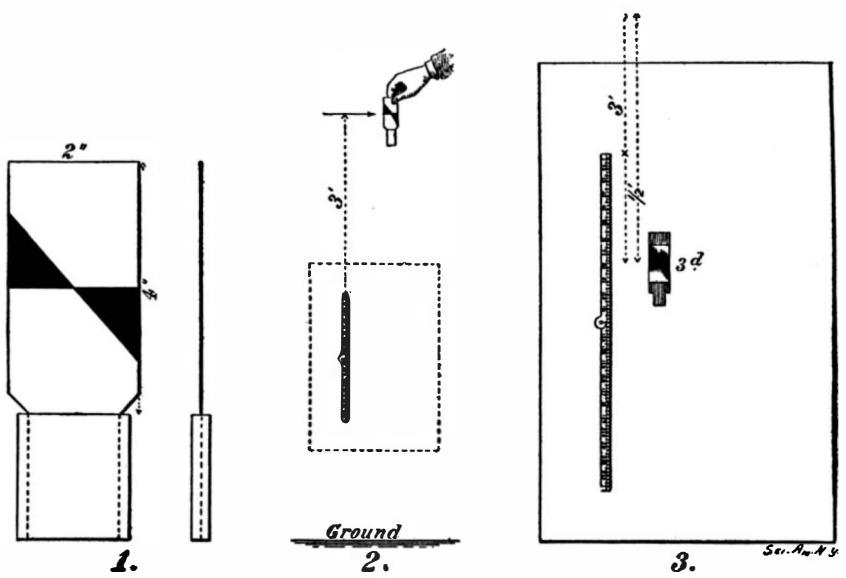


DIFFRACTION-SCOPE.

large size for spectroscopic work. Starting with a one inch grating of 2,000 lines, I have built up a grating eight inches square, which, when placed over the object-glass of a telescope, showed the dark band in the spectrum of Sirius with great distinctness. No especial precautions, other than the use of the flat glass plate, were taken to insure absolute parallelism of the lines, and I have not had time to thoroughly test the grating. The spectra, however, are of extraordinary brilliancy, and, on the whole, the field seems promising."

THE MEASUREMENT OF SHUTTER SPEED.

There are to-day published a number of tables giving the proper time of exposure for different subjects in different classes of light, at all hours of daylight, and all seasons of the year. These tables are a valuable guide to photographers; but in order to use them intelligently, it is necessary to know the speed of one's shutter. The figures found on the indicator dials of most shutters are far from accurate, but are generally accepted as correct because at first sight the measurement of a shutter's speed, when set for instantaneous work, appears too difficult to be attempted. It may, however, be accomplished quite accurately in the following simple manner. Take a piece of white cardboard shaped as shown in Fig. 1, and draw upon it the figure shown, being careful that the upper edge of the lower black triangle is in prolongation of the lower



THE MEASUREMENT OF SHUTTER SPEED.

edge of the upper triangle. Now insert the narrow part of the card in a piece of lead pipe about 2 inches long and 1 inch in diameter, and then flatten the pipe so as to fasten it securely to the card. With the addition of an ordinary 2-foot rule, this is all the apparatus needed.

Select a brightly lighted wall, and mark a point about 6 feet above the floor or ground. Then fasten the rule vertically against the wall with its upper end exactly 3 feet below the mark. Set up the camera squarely in front of the rule and at such a distance as will give the largest possible image of the entire length of the rule. Focus sharply and use a small stop.

The card should now be held so that its center mark is just beside the 6-foot mark on the wall. Fig. 2 shows all in readiness for the drop, the dotted rectangle representing the field of view of the camera.

Now release the weighted card so that it will fall close beside the rule, and expose the plate while the card is passing the rule. This will require care, and it would be well to practice it several times without withdrawing the plate-holder slide.

The plate must now be developed, and will show a picture like Fig. 3, in which the center mark of the card is blurred by its motion. This motion must be measured by the scale shown in the photograph of the rule (never with the rule itself), and must be expressed in feet. Call this distance d.

Let t be the time in seconds that the shutter was open. Then $\frac{d}{t} = v$, the velocity of the card in feet per second at the time of exposure. Observe the distance that the center of the blurred mark has fallen below the upper end of the rule. Add 3 feet, and the sum is the total distance that the card has fallen. Call this h.

Neglecting air resistance, we have from the law of falling bodies $v = \sqrt{2gh}$. Equating the two values of v, we have $\frac{d}{t} = \sqrt{2gh}$. Solving for t, we find $t = \frac{d}{\sqrt{2gh}}$, in the second member of which all the quantities are known.

Example.—$d = 3'' = 0{\cdot}25'$; $h = 4'$; g may be assumed as 32·2. Then $t = \frac{d}{\sqrt{2gh}} = \frac{0{\cdot}25}{\sqrt{257{\cdot}6}} = 0\ 0156$ second, approximately.

The card may be dropped from a greater height than 3 feet above the rule, and the greater the fall of the card, the greater will be the accuracy of the result; but the greater will be the difficulty of getting the picture of the card at the proper place.

The following table gives shutter speeds from $\frac{1}{500}$ of a second to about $\frac{1}{30}$ of a second with sufficient accuracy for ordinary purposes. By placing the camera at a greater distance from the wall and using a longer drop of the card, the table may be extended as desired.

Total Fall in Inches.	Fall of Card During Exposure, in Inches.											
	0·5	1·0	1·5	2·0	2·5	3·0	3·5	4·0	4·5	5·0	5·5	6·0
36.....	0·003	0·006	0·009	0·012	0·015	0·018	0·021	0·024	0·027	0 030	0·033	0·036
42.....	0 003	0·006	0·008	0·011	0·014	0·017	0·020	0·022	0·025	0·028	0·031	0·034
48.....	0·003	0 005	0·007	0·010	0·013	0·016	0·018	0·021	0 023	0·026	0·028	0·031
54.....	0·003	0·005	0·007	0 010	0·013	0·015	0·018	0 020	0·022	0·025	0·027	0·030
60.....	0·002	0·004	0·007	0·009	0·012	0·014	0·017	0·019	0·021	0·023	0·026	0·028

R. R. Raymond,
First Lieutenant Corps of Engineers,
Boston, Mass. United States Army.

An Automobile Journey from Cleveland to New York.

On Monday, May 22, a Winton motor carriage started from Cleveland for New York. The distance from Cleveland to Buffalo, 218 miles, was covered in 11 hours. On May 23 the carriage ran from Buffalo to Fairport, 94 miles, in 7 hours. On May 24 it ran from Fairport to Syracuse, 80 miles, in 7 hours and 48 minutes. On May 25 the carriage ran from Syracuse to Albany, a distance of 154 miles, in 11 hours and 52 minutes. The total distance traveled was 546 miles; the total time 37 hours and 40 minutes to Buffalo. The difference between the roads from Cleveland to Buffalo and Buffalo to Albany is clearly shown by the difference in running time. The carriage in use weighs 1,700 pounds and is driven by a six horse power motor.

Americans Elected to the Royal Institution.

The Royal Institution of Great Britain, in commemoration of its centenary, has elected a number of American honorary members. The list includes Dr. Samuel Pierpont Langley, Secretary of the Smithsonian Institution, Prof. A. A. Michelson, of Chicago, Prof. R. H. Thurston, of Cornell University, Prof. George F. Barker, of the University of Pennsylvania, and Prof. W. L. Wilson, President of Washington and Lee University, and former Postmaster-General.

An atlas, in sixty-five sheets, of the upper Yangtse-Kiang River, drawn from the surveys of Father Chevalier, of the Jesuit observatory at Si Ka-wei, is about to be published at Shanghai.

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Correspondence.

Fire Protection in Paris.

To the Editor of the SCIENTIFIC AMERICAN:

In a recent number of your estimable paper, the SCIENTIFIC AMERICAN, you published a very interesting article on "Fire Precautions in Paris," in which you rightly attribute the fewer disasters by fire in Paris to the manner in which the houses there are constructed. The information you give is, however, incomplete, for you speak only of the exterior of the houses, while it is the interior especially which gives the greatest guarantee against the rapid development of fires such as we see too often here. The architects who go to Paris in 1900 would do well to study the matter in order to apply the construction to American dwellings.

In America the motto is "build quickly." Thus we see houses of considerable importance rise from the earth and open their doors to their occupants scarcely a month after the laying of the first stone. The various materials—foundations, corner stones, doors, windows, cornices, etc.—are prepared in advance by different contractors, and all that is necessary is to add to these a large number of laborers working with the greatest celerity and superintended with discipline.

This system offers the advantage of making capital more quickly productive, but it offers a drawback as regards the solidity of the edifice and the security of the inhabitants, since wood forms the largest proportion of the materials used. Although the entire outside surface may be of brick, all the interior framework of the house is of wood. Floors and ceilings, staircases and closets, and the roof, covered with plates of tin or sheets of tarred paper, are all of wood. Wood is everywhere, and what wood? The most resinous kinds, such as fir and pitch pine, so that it needs only a small fire in a corner of the cellar for the whole house, which is all built of inflammable material, to be immediately enveloped in flames. In such a dwelling, the occupant may well ask himself each night if he will awake in the morning.

At Paris the scourge of flame proceeds less rapidly, and it is only in a provisional edifice built of wood, such as the Charity Bazar, or in an old theater like the Opera Comique, which has not the improvements required by the later building laws, that disasters have occurred similar to the recent fires in New York.

In France, the method of construction of a house differs completely from that employed here. The heavy work, that is to say the main walls, are all of dressed stone or rough blocks faced with mortar, the girders and cross beams are of iron, the ceilings are arched and of brick, the stairs of stone or marble, the floors of terra cotta tiling (diamond or hexagonal in shape), the interior walls are of hollow bricks placed edgewise, the roof of blocks of terra cotta covered with tiles or slate, the chimneys of marble, and finally, the doors and windows, the friezes, cornices, casings, baseboards, and other woodwork, are all of oak or walnut. It will readily be seen, therefore, that the proportion of inflammable material is relatively small in such a house, which makes it possible to confine a fire very easily to the place where it started. This is the reason that a fire often breaks out in the cellar of a building full of inflammable materials such as petroleum, oils, or varnish, without doing damage to the rest of the building.

There is another cause of disasters resulting from the tolerance of the building commissioners, who allow cellers to be extended under the street, with vent holes opening in the sidewalks. A single match dropped by a passer-by and falling through one of these vent holes into the cellar may cause one of the greatest conflagrations.

Finally I must mention, as a very good measure in France, the almost universal use of Swedish safety matches, which can only be lighted by scratching on the side of the box, so that a stray match is not capable of igniting by accident, and thus causing a fire.

Although America may be less favored than France with regard to the rapid development of fires, she is on the contrary far better organized to combat them. Her apparatus, machines, and fire engines have reached the greatest perfection, as has everything else which is connected with mechanics and the application of forces. The organization of her engine houses is perfect, and the start for a fire almost instantaneous. As the engines and men are distributed in numerous stations in the different parts of the city, it takes but a few minutes after the alarm has been given to have the pumps working at the fire.

From what precedes it will be noted that each country may get useful ideas from the other. It is by eclecticism that we approach perfection. The great international expositions, such as the World's Fair in America and the exposition at Paris next year, are the most efficacious means of obtaining the supreme degree of perfection in all things. ET. MICHEL.

112 Summit Street, Newark, N. J.

ONE-THIRD of the people who go mad are said to recover their senses.

Miscellaneous Notes and Receipts.

Safe Bengal Fire.—Bengal fire free from danger is produced from powdered aluminum 12 parts, barium nitrate 12 parts, saltpeter 12 parts, yellow dextrine 2 parts, sulphur 2 parts, and gum arabic 5 parts.—Neueste Erfindungen und Erfahrungen.

Waterproof Canvas.—The canvas is coated with a mixture of the three solutions named below:

1. Gelatine, 50 grammes, boiled in 3 liters of water free from lime. 2. Alum, 100 grammes, dissolved in 3 liters of water. 3. Soda soap dissolved in 2 liters of water.—Suddeutsche Apotheker Zeitung.

Hard Soldering with Acetylene.—The flame of acetylene is exceedingly useful for hard soldering, says Neueste Erfindungen und Erfahrungen. Its temperature is as high as can otherwise be obtained only with a special blowing apparatus. The heating power of acetylene is likewise very great. The use of acetylene is particularly in place where no connection with a gas house or electric central station can be had.

Waterproof Lacquer or Glaze.—By making shellac into an emulsion in water by the aid of an alkali or alkaline salt, a solution is obtained which may be mixed with colors or used alone and provides paper, cardboard and wood with a waterproof coating that can be polished by means of friction or pressure. For maps, playing cards, cardboard boxes used for packing, etc., this varnish is exceedingly suitable. The same effect is produced by the use of certain phosphates. If an insoluble powder is mixed with a gelatinous phosphate, especially an alkaline earth, a substance is obtained which applied on paper or cardboard renders it watertight and can likewise be polished by friction or pressure.—Farben Zeitung.

Red Lakes from Coralline.—Dissolve 10 kilos of coralline soluble in alcohol in a solution of 6 kilos of caustic soda 70 to 72 per cent in about 60 liters of water and thin with water to about 300 liters. The dark red opaque solution is mixed with 120 kilos of finely ground heavy spar, and finally precipitated with a solution of 40 kilos of lead acetate in water. The quantity necessary for a complete precipitation varies according to a large or small percentage of impurities in the coralline. By making a dab-test on filtering paper it can be readily ascertained whether the liquid has become colorless. When the precipitated lake has settled well, it is washed three times, each time with 500 liters of water, whereupon the pigment is filtered and dried. About 160 to 165 kilos of dry, dark red lake is obtained. If larger quantities of heavy spar are used, the color becomes paler up to pink. By mixing with minium a handsome imitation vermilion is produced. Unfortunately these lakes cannot be employed for oil colors, because in that case they soon turn yellow. But they are excellent for printing on wall paper, and also endure direct sunlight well.—Svensk kemisk Tidskrift.

To Clean Brushes and Vessels of Dry Paint.—The cleaning of the brushes and vessels in which the varnish or oil paint has dried is usually done by boiling with soda solution. This frequently spoils the brushes or cracks the vessels if of glass; besides, the process is rather slow and dirty. A much more suitable remedy is amyl acetate, which is a liquid with a pleasant odor of fruit drops, used mainly for dissolving and cementing celluloid. If amyl acetate is poured over a resinfied oil paint brush the varnish dissolves almost immediately and, though ever so hard and dry, the brush is again rendered serviceable at once. If necessary, the process is repeated. For cleaning vessels shake the liquid about in them, which softens the paint so that it can be readily removed with paper. In this manner much labor can be saved. One kilo of pure amyl acetate costs 2 marks (50 cents), hence the method is cheap as well. The amyl acetate can be easily removed from the brushes, etc., by alcohol, oil of turpentine or varnish.—Farben Zeitung.

Process for Producing Gold-like Alloy from Copper and Antimony.—This invention, patented in Germany, covers a metallic alloy, to take the place of gold, which, even if exposed for some time to the action of ammoniacal and acid vapors, does not oxidize or lose its gold color. It can be rolled and worked like gold and has the appearance of genuine gold without containing the slightest admixture of that metal, besides being much cheaper than other precious and semi-precious metals, as well as the compounds and alloys used as substitutes for precious metals. The alloy consists of copper and antimony in the approximate ratio of 100 to 6 and is produced by adding to molten copper, as soon as it has reached a certain degree of heat, the said percentage of antimony. When the antimony has likewise melted and entered into intimate union with the copper, some charcoal ashes, magnesium and lime-spar are added to the mass when the latter is still in the crucible. Although the action of this material admixture of flux is not entirely explained, the alloy loses thereby a certain porosity otherwise present and an exceedingly great density of the cast metal is obtained. Same can now be rolled, wrought, hammered and soldered like gold, and when polished has the appearance of genuine gold, while being considerably firmer than the latter.—Journal der Goldschmiedekunst.

Science Notes.

Dr. Palisa has given the name "Slatin" to the small planet which was discovered by him on the 9th of March last.

It has been suggested that the hook and ladder companies of the New York fire department carry small tanks of pure oxygen for use in resuscitating people who have been partly asphyxiated by smoke or escaping gas.

The Edinburgh, Scotland, Corporation made an appeal to Parliament for power to deal with street advertising abominations, including the enforced illumination of wall spaces at night. Six other cities are seeking to obtain the same permission.

We have already noted the fact that a party of scientists was to go to Alaska to carry on investigations. They have now taken their departure, and among those in the party are Dr. C. Hart Merriam, biologist, Prof. Coville, of the Department of Agriculture, and Dr. B. E. Fernow, head of Cornell School of Forestry.

A new monument is to be erected at Eisenach, Germany, and over one thousand designs were sent in by no less than three hundred competitors. The committee selected three designs as being the best, and when the sealed envelopes were opened, it was found that all three selected were by the same sculptor, Herr Kreiss, of Dresden.

Jabez Hogg, who was well known in London as an ophthalmic surgeon, died recently aged eighty-two years. He wrote many books upon the eye, but he will be principally remembered by his "The Microscope: Its Construction and Applications," which is well known to every microscopist. At the time of his death this book was in its fifteenth edition.

Both Mexico and Japan propose to establish life saving and signal systems along their coasts and will employ the Coston night signals, which are now generally used by the army and lighthouse service. They were invented by the widow of Capt. Coston, of the American corps. It is said that she is the only woman who ever invented an article that could be adopted by the military or naval service.

Sir Robert Ball recently unveiled a bronze tablet at No. 19 New King Street, Bath, England, recording the fact that William Herschel, the great astronomer, resided there. Herschel discovered the planet Uranus from the back garden of that house. Sometimes he found it necessary to bring his telescope out into the street opposite that house, and many of the discoveries were made in the street.

Gen. A. R. Buffington recently made a visit to the Springfield arsenal and looked into the proposed improvements of the Krag-Jorgensen rifle. An important change that has been proposed is the adoption of a band clip which admits of the feeding of cartridges into the magazine of the gun in bunches of five, instead of singly, as soldiers are now compelled to do. Probably the most important change of all relates to the cartridges, which will allow of six cartridges to a magazine instead of five.

Sir Norman Lockyer has lately been experimenting with a flexible film with the idea of adapting it to spectroscopic photography, according to The Pharmaceutical Journal. The large concave Rowland grating which he is now using for his solar spectroscopic photographs is 21½ feet radius and has 20,000 lines to the inch ruled on its surface. It gives a spectrum 30 inches long. The focal plane of this grating is of necessity considerably curved; it is, therefore, impossible to get a sharp photograph of the whole spectrum on a glass plate; in fact, not more than 18 or 20 inches of the spectrum can be brought into focus on the same plate. The difficulty is gotten over by using a flexible film which is bent to the curvature of the field. The print of the photographs taken with this Rowland concave grating is the longest solar spectrum photographed at a single operation. It is 30 inches long.

Great damage was recently done in Philadelphia by the ignition of benzole vapor. The accident occurred in the chemical laboratory of a manufacturer of chewing gum. The building was badly damaged. The accident caused three deaths, and twelve or fifteen persons were seriously injured. The whole force of the explosion was upward and outward. At first it was thought that the boiler had exploded, but it was found intact. On the ground floor was a tank containing about seventy-five gallons of benzole. There was also a certain amount of other chemicals used in the manufacture of vanillin. On the second floor was another tank of benzole of about the same capacity. It was while mixing the benzole and certain other ingredients from which vanillin is made that the tank became overheated and overflowed. The inflammable vapor of benzole probably reached the engine room, where its ignition caused the explosion. We have many times pointed out the dangerous nature of the vapor of benzole, benzine, naphtha, and carbon bisulphide, and the serious nature of this accident shows that experimenters should be more cautious than ever in handling even small amounts of such inflammable chemicals.

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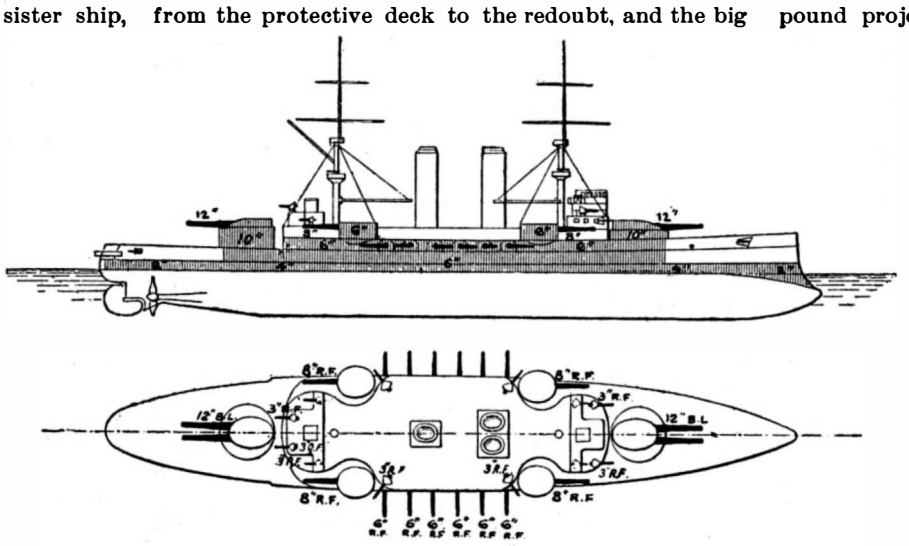
NAVIES OF THE WORLD.

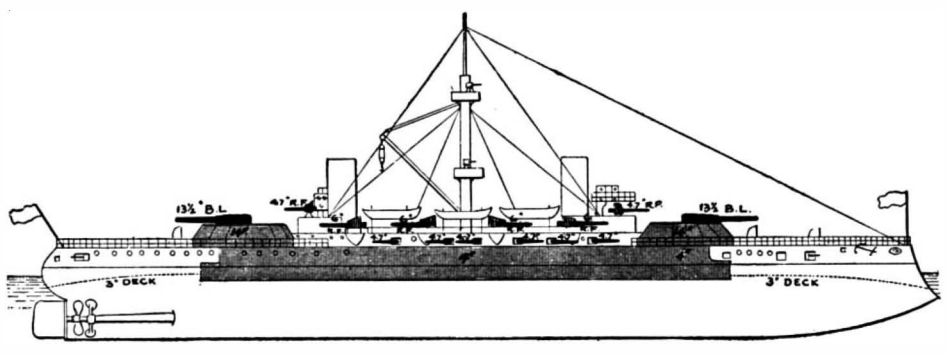
VI. ITALY.

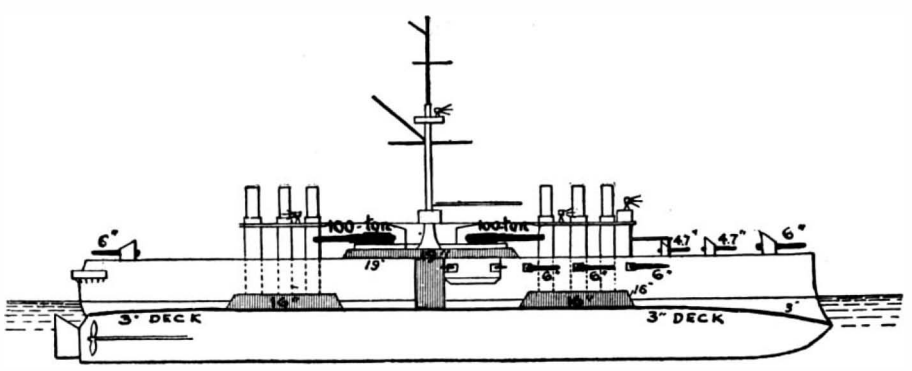
BATTLESHIPS.—The mention of the Italian navy suggests at once the huge battleships and cruiser-battleships which were for many years the characteristic feature of this, as distinguished from the other great navies of the world. As far back as the year 1876, the Italians had launched a battleship, the "Duilio," of the then unprecedented displacement of over 11,000 tons, which carried 21½ inches of armor on her sides and mounted four huge muzzle-loading guns of 17¾ inches caliber and 100 tons weight as her main armament. Two years later, she was followed by a sister ship, the "Dandolo." These two vessels produced a veritable sensation, for there was nothing afloat, even in the British navy, to compare with them, the nearest approach being the "Devastation" of 9,330 tons and the "Dreadnought" of 10,820 tons, which, however, carried only four muzzle-loading 36-ton guns, and armor 12 and 14 inches in thickness. The 17¾-inch 100-ton muzzle-loader has a muzzle energy of 33,220 foot-tons and is capable of penetrating 18 inches of steel at a thousand yards and 16 inches at twenty-five hundred yards. As the armor-piercing and the common shell weigh a ton, and carry a bursting charge respectively of 30 and 80 pounds of powder, it can be seen that the old "Duilio" is a powerful coast defense vessel, despite her age. Of the two ships the "Duilio" remains practically unchanged, but the "Dandolo" has recently had her muzzle-loaders replaced by modern 10-inch breech-loading rifles, and a world. In the first place, massive side armor, or indeed any side armor whatever, was abandoned, and reliance was placed in a thick, curved deck placed several feet below the waterline, and associated with a minute cellular subdivision of the space above the deck at the level of the waterline. Massive inclined armor was placed around the smokestacks where they entered the protected deck. The vessels were given a lofty freeboard throughout, and the armament of four 100-ton breech-loading guns was placed within a diagonal redoubt of 19-inch armor, resting upon the flush main deck. A heavily armored ammunition hoist led from the protective deck to the redoubt, and the big and guns until she ran into close range she would be a most dangerous antagonist. In a recent test of the naval war game, the "Italia" was matched against the British "Magnificent." The boats approached head on, the "Italia" reserving her fire until she was within point-blank range, when she let fly with all four 105-ton guns at the same instant at the forward transverse bulkhead of the enemy. The victory was awarded to the "Italia," as it was considered that the bulkhead of the "Magnificent" would have been smashed in and the engines and boilers wrecked by the 200,000 foot tons of energy embodied in the four 2,000-pound projectiles.

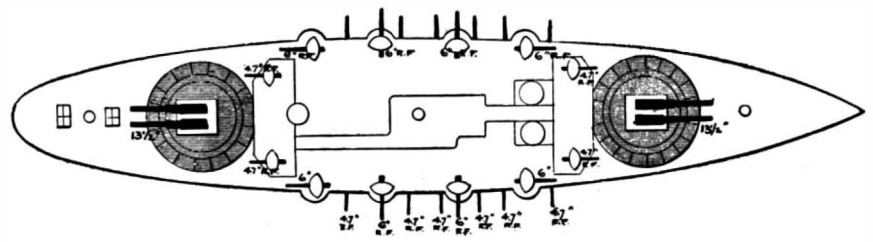


First-class Battleship "Benedetto Brin." Also "Reina Margherita."
Displacement, 12,765 tons. **Speed,** 21 knots. **Normal Coal Supply,** 1,000 tons. **Armor:** Belt, 6 inches; gun positions, 6 and 10 inches; deck, 3 inches. **Armament,** four 12-inch, four 8-inch, twelve 6-inch, ten 3-inch, six 1·8-inch. **Torpedo Tubes,** 4 (submerged). **Complement,** 600. **Date,** 1899.

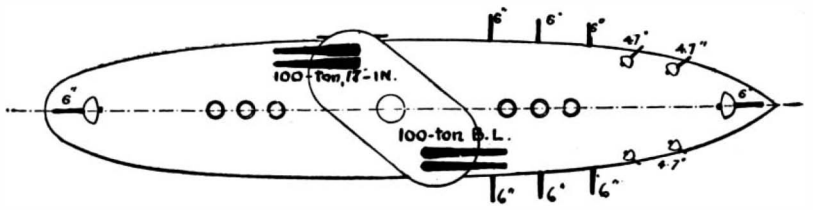
The "Italia" type was not repeated, and the next lot of battleships, the "Andrea Doria," "Francesco Morosini," and "Ruggiero di Lauria," launched in 1884-85, are a reversion to the "Duilio" type. They are provided with a belt extending amidships in the wake of engines and boilers, above which is a diagonal redoubt reaching to the main deck. Within the redoubt are four 17-inch 105-ton breech-loading rifles, disposed in pairs diagonally or *en echelon*, as in the "Italia." The armor, which is of the English compound type, is 17·7 inches in thickness on the belt and redoubt, and 14 inches on the bulkheads. The deck is 3 inches in thickness. The trial speed of the ships was from 16 to 17 knots; but the sea speed would not probably be over 14. The armament is, of course, of tremendous power, no vessels in the world being able to deliver such a combined attack at a single discharge as these vessels



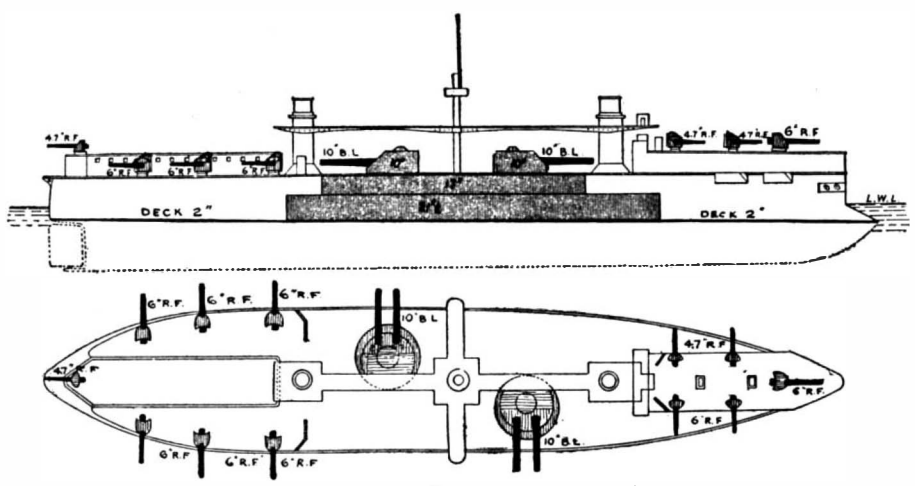




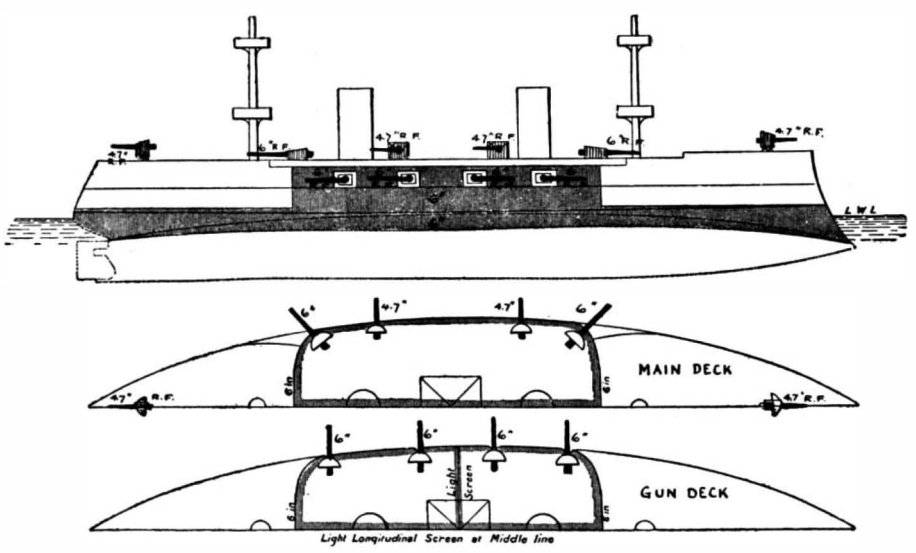
First-class Battleship "Re Umberto." Class of Three Ships.
Displacement, 13,860 tons. **Speed,** "Re Umberto," 19 knots; "Sicilia," 20·2 knots; "Sardegna," 21·2 knots.



First-class Battleships "Italia" and "Lepanto."
Displacement, 14,400 tons. **Speed,** 18·4 knots.



Second-class Battleships "Duilio" and "Dandolo."
Displacement, 11,200 tons. **Speed,** 15·6 knots. NOTE.—"Dandolo" has been reconstructed and rearmed as per data given. Similar changes were proposed for the "Duilio," but probably will not be made. She now carries four 17-inch 100-ton muzzle-loading guns as her main armament.



Armored Cruisers "Vettor Pisani" and "Carlo Alberto."
Displacement, 6,500 tons. **Speed,** 20 knots.

NAVIES OF THE WORLD—VI. ITALY.

powerful battery of eight 6-inch and four 4·7-inch rapid-fire guns has been mounted on the main and superstructure decks. The 6-inch guns on the main deck have necessitated the sacrificing of the dead astern fire of the 10-inch guns; but as the "Dandolo" is designed to fight anything afloat, the loss is only nominal. She can still concentrate four 10-inch, one 6-inch, and two 4·7-inch guns dead ahead.

Not content with the unusual dimensions of the "Duilio" and her mate, the Italians proceeded to even greater extremes in the "Italia" and "Lepanto," launched in 1880 and 1883, both of which were of about 14,400 tons displacement. These vessels are of special interest, both on account of the many radical features embodied in their design, and because they anticipated by a dozen years or more the size and speed which are only now becoming usual in the navies of the guns were placed in barbette at a height of over 30 feet above the waterline. The weight saved in armor was put in motive power, the "Lepanto" developing 15,800 horse power with a resulting speed of 18·38 knots per hour. The object aimed at in these vessels was to produce a warship which by virtue of her speed could accept or refuse battle as she pleased, that could choose her own fighting distance, and that could steam swiftly to close quarters and deliver a crushing attack with her monster guns before the enemy could do fatal injury to her unprotected hull. For those days of big guns and slow fire it was an ingenious theory; but the rapid-fire guns of a modern ship would speedily wreck the supporting structure of the barbette and big guns, and bring the latter crashing down into and possibly through the hull of the vessel. Nevertheless it is certain that if the "Italia" could maintain the integrity of the barbette and the "Italia" and "Lepanto." The guns of the "Andrea Doria" fire a 17-inch 2,000-pound projectile, with a muzzle energy of 55,030 foot-tons and a penetration through iron of 35 inches. The combined energy of her fire in any direction would thus be 220,120 foot-tons for a single round from these guns alone.

The great defect of these ships is their low freeboard (freeboard being sacrificed to armor) and the concentration of the whole main battery in one redoubt, where a single heavy shell might disable every gun. Also, judged by modern ideas, the absence of a numerous secondary rapid-fire battery is a fatal weakness.

Following the "Andrea Doria" class came the three battleships "Re Umberto" (1888), "Sardegna" (1890), and "Sicilia" (1891), in which a return was made to the extreme dimensions of the "Italia." The displacement and speed of these three ships are about the

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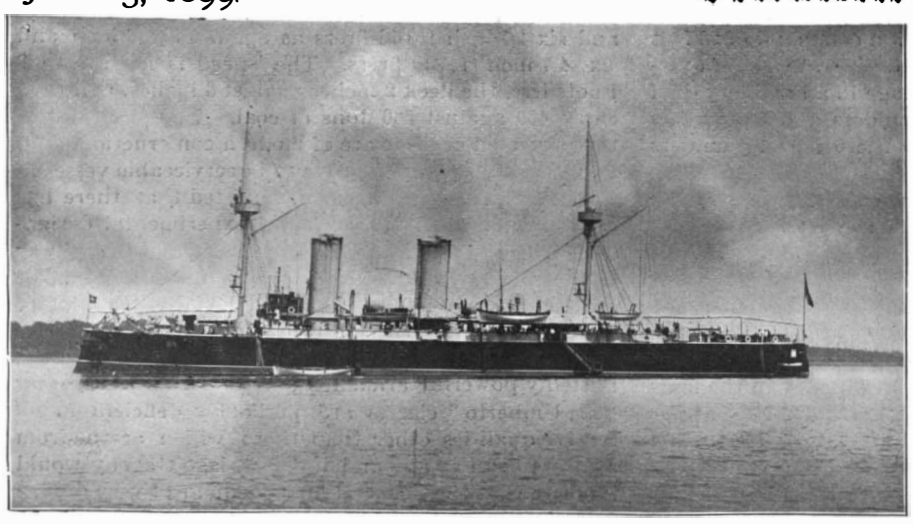
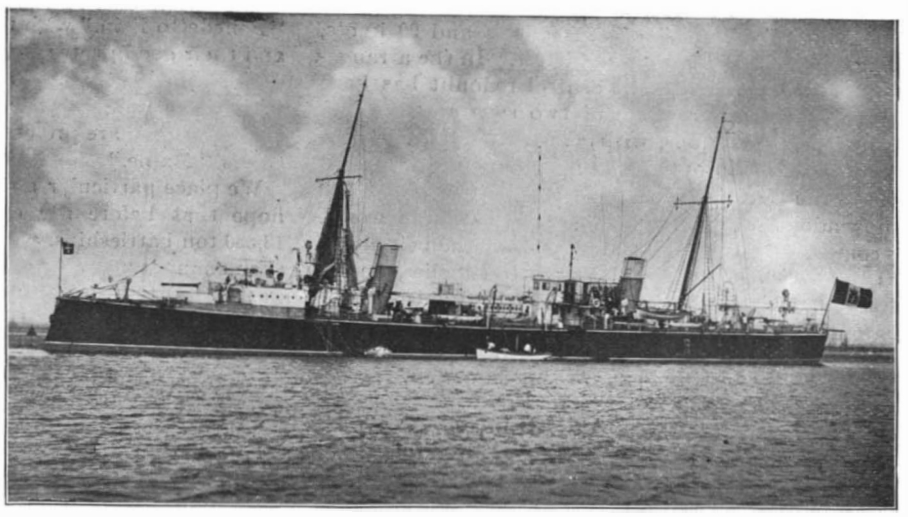
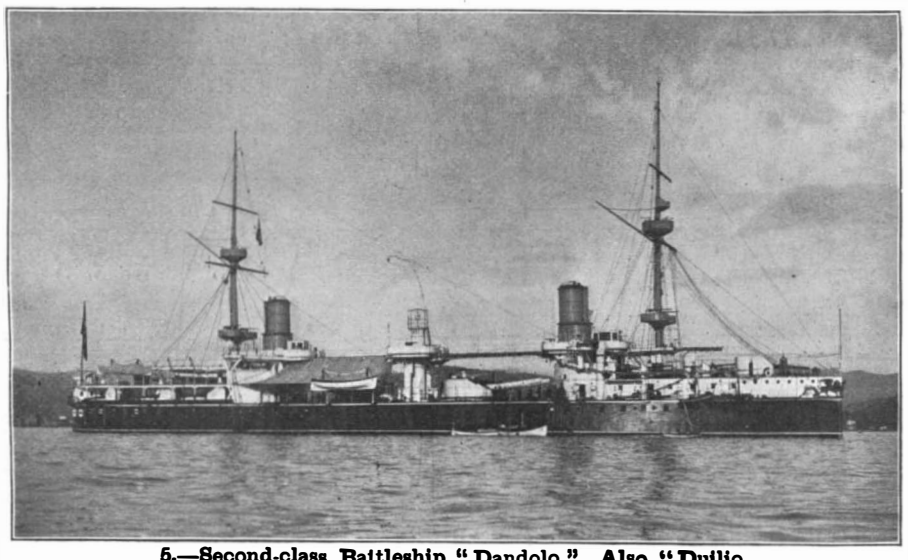


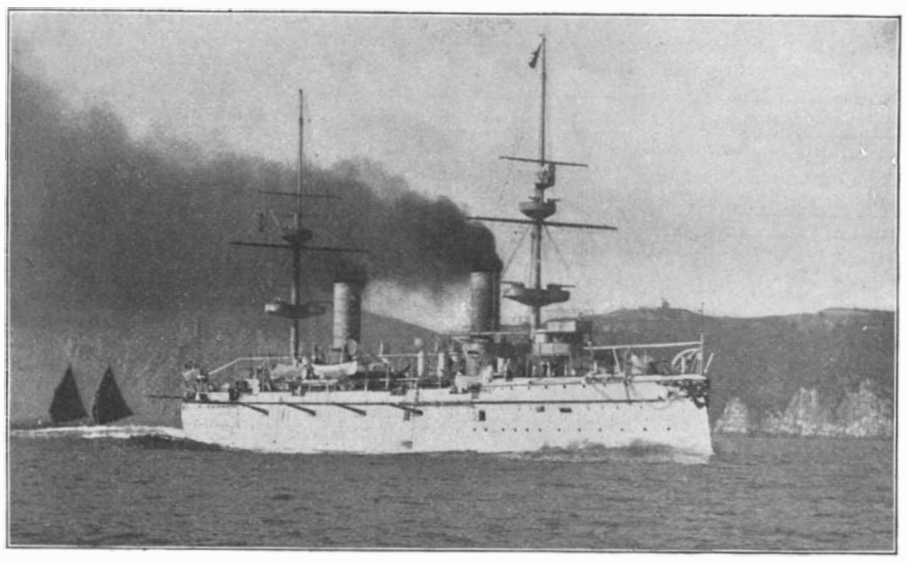
3.—Third-class Protected Cruiser "Etruria." Class of Three Ships.
Displacement, 2,280 tons. **Speed,** 19·8 knots. **Normal Coal Supply,** 400 tons. **Armor:** Deck, 2 inches; gun positions, 4½ inches. **Armament,** four 5·9-inch rapid-firers, six 4·7-inch rapid-firers, one 2·9-inch rapid-firer, eight 2·2-inch, ten 1·4-inch rapid-firers, two machine-guns. **Torpedo Tubes,** 2. **Complement,** 257. **Date,** 1891.



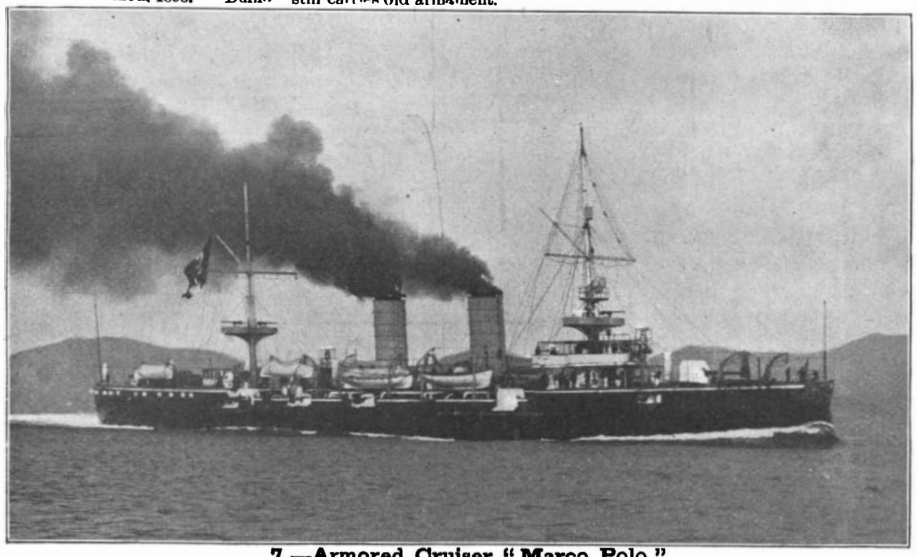
4.—Torpedo Gunboat "Partenope." Class of Eight Vessels.
Displacement, 840 tons. **Speed,** 19 knots. **Normal Coal Supply,** 100 tons. **Armor:** 1-inch deck; light gun shields. **Armament,** one 4·7-inch rapid-fire gun, six 2·2-inch and three 1·4-inch rapid-fire guns. **Torpedo Tubes,** 5. **Complement,** 111. **Date,** 1890.



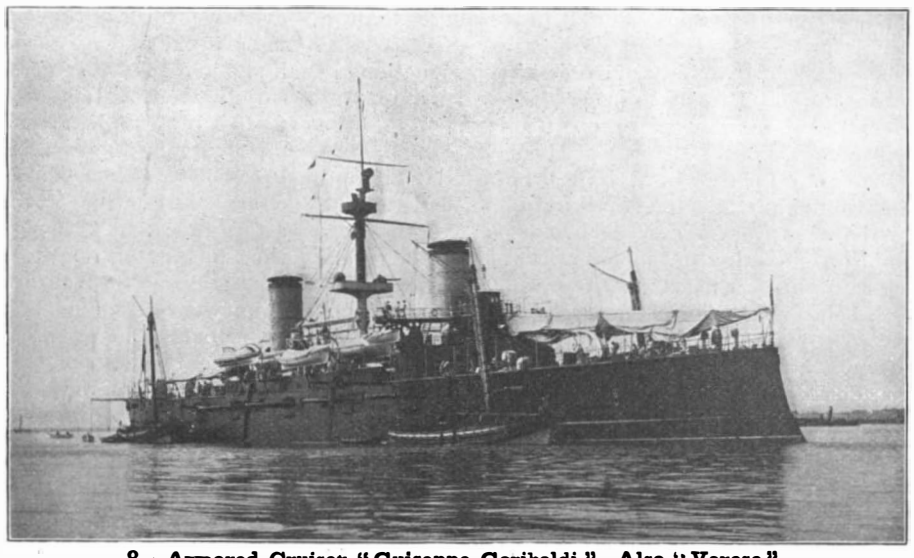
5.—Second-class Battleship "Dandolo." Also "Duilio.
Displacement, 11,203 tons. **Speed,** 15·6 knots. **Normal Coal Supply,** 1,000 tons. **Armor:** Belt, 21½ inches; gun positions, 18 inches; deck, 2 inches. **Armament,** four 10-inch B. L. rifles, seven 6-inch rapid-fire guns, five 4·7-inch rapid-fire guns, two 2·9-inch, ten 2 2-inch, fourteen 1·4 inch rapid-fire guns, two machine guns. **Torpedo Tubes,** 4. **Complement,** 487. **Date,** 1878; 'Dandolo refitted and rearmed, 1898. "Duilio" still carries old armament.



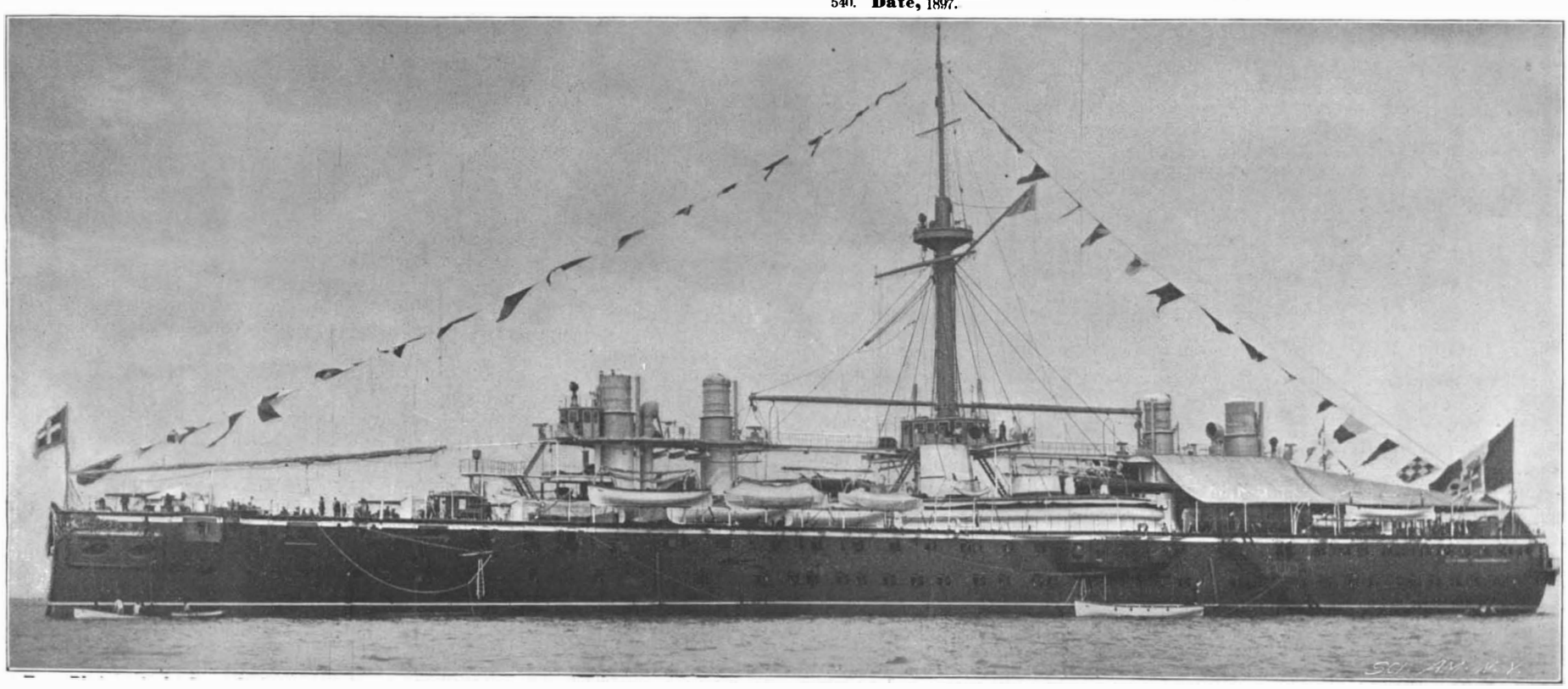
6.—Armored Cruiser "Vettor Pisani." Also "Carlo Alberto."
Displacement, 6,500 tons. **Speed,** 20 knots. **Normal Coal Supply,** 600 tons. **Armor:** Complete belt, 6 inches; central battery to main deck, 6 inches; gun positions, 6 inches; deck, 1½ inches on flats. **Armament,** twelve 6-inch rapid-fire guns, six 4·7-inch rapid-fire guns, two 2·9-inch, ten 2·2-inch, ten 1·4-inch rapid-firers, two machine guns. **Torpedo Tubes,** 4. **Complement,** 460. **Date,** 1895.



7.—Armored Cruiser "Marco Polo."
Displacement, 4,583 tons. **Speed,** 19 knots. **Normal Coal Supply,** 630 tons. **Armor:** Belt and bulkheads, 4 inches; gun positions, 4 inches; deck on flats, 1 inch. **Armament,** six 6-inch rapid-firers, ten 4·7-inch rapid-firers, two 2·9-inch rapid-fire, nine 6-pounders, four 1-pounders, two machine guns. **Torpedo Tubes,** 5. **Complement,** 315. **Date,** 1890.



8.—Armored Cruiser "Guiseppe Garibaldi." Also "Varese."
Displacement, 7,400 tons. **Speed,** 20 knots. **Normal Coal Supply,** 650 tons. **Armor:** Complete belt, bulkheads, and redoubt extending to main deck, all 6 inches; gun positions, 6 inches; deck, 1·4 inches on flats. **Armament,** one 10-inch, two 8-inch rapid-firers, fourteen 6-inch rapid-firers, ten 2·9-inch, six 1·8-inch rapid-firers, and two machine guns. **Torpedo Tubes,** 4 (submerged). **Complement,** 540. **Date,** 1897.



From Photographs by Symonds & Company, Portsmouth, England. 9.—First-class Battleship "Lepanto." Also "Italia.
Displacement, 14,440 tons. **Speed,** 18·4 knots. **Normal Coal Supply,** 1,650 tons. **Armor:** At base of funnels, 16 inches; barbettes, 19 inches; deck, 3 inches. **Armament,** four 17-inch, 100-ton B. L. rifles, eight 6-inch, four 4·7-inch rapid-fire guns, twelve 2·2-inch, thirty-four 1·4-inch, and two machine guns. **Torpedo Tubes,** 4. **Complement,** 748. **Date,** 1888.

NAVIES OF THE WORLD—VI. ITALY.

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same, the "Sardegna," of 13,860 tons and 20 knots, being slightly the largest and fastest. In the arrangement of their armament the central redoubt has been abandoned and the system of two separate fore and aft main gun positions, with a central rapid-fire battery amidships, adopted. This arrangement was first used in the "Admiral" class of the British navy, and is now adopted universally in the navies of the world. As compared with the "Andrea Doria," the belt armor has been reduced from 17·7 inches to 4 inches, and it covers about two-thirds of the length amidships, extending to the main deck. The barbettes project above this deck to a height of about 13 feet, the axis of the main 13½-inch guns being about 26 feet above the waterline. This gives a good command, but the seagoing qualities of these fine ships would have been greatly improved if the amidships superstructure deck had been carried out to the bow as in our own "Alabama" and "Maine" classes. The 13½-inch gun weighs 68 tons, and fires a 1,250-pound projectile with a muzzle energy of 35,230 foot-tons and a muzzle penetration of 33 inches of iron. The amidships rapid-fire battery of these ships is unusually powerful, consisting of twelve 4·7-inch guns on the main deck, eight 6-inch guns on the superstructure deck, and four 4·7-inch guns on the bridges, two forward and two aft. None of this battery, however, has more than shield protection, and its formidable character is modified by the meager character of the side armor. Strictly speaking, these ships belong to the armored cruiser class, for they could never lie in line of battle against well protected battleships with much hope of success.

The faults of the "Re Umberto" are corrected in the "St. Bon" and "Emmanuele Filibert," launched in 1897, in which, on the small displacement of 9,800 tons, the Italians have secured the following admirable qualities; a complete Harveyized belt tapering from 9¾ inches amidships to 4 inches at the ends; a belt above this of 6-inch armor extending to the main deck and covering the sides between the barbettes; two 9¾-inch turrets protecting a main battery of four 10-inch guns, and a continuous wall of 6-inch steel surrounding a central battery of eight 6 inch rapid-fire guns on the main deck; eight 4·7-inch guns protected by shields, carried on the superstructure, and twenty-four smaller rapid-fire guns. The speed is 18 knots and the normal coal supply 1,000 tons. Although she is 50 per cent smaller, the "St. Bon" would prove more than a match for the "Re Umberto."

The latest Italian ideas of battleship construction are shown in the "Benedetto Brin" class, which at present includes two ships of 12,765 tons displacement and the unprecedented battleship speed of 21 knots. The "Benedetto Brin" is being built at Castellamare and the sister ship, "Regina Margherita," at Venice. The particulars are as follows: An armor belt 6 inches thick amidships tapering to 2 inches at the ends and reaching from the bow nearly to the stern. Above this a 6-inch belt extending between the barbettes and connected by transverse bulkheads which inclose the bases of the barbettes. This upper belt reaches to the spar deck and thus provides a complete central redoubt of 6-inch armor. The barbettes are protected by 10-inch armor and each contains a pair of 12-inch breech-loading rifles. The after barbette is carried on the main deck, and on the same deck, within the central citadel, is a rapid-fire battery of twelve 6-inch guns mounted in broadside. On the spar deck above, at each corner of the casemate, is a turret protected by 6-inch armor, carrying an 8-inch rapid-fire gun, and forward on the same deck is mounted the forward pair of 12-inch rifles. Ten 3-inch and six 1·8-inch guns are carried on the superstructure and bridges. It is evident that the high speed and powerful armament of these ships must have been gained at the expense of the defensive powers. This is best shown by a comparison of this vessel with the "Maine" of our own navy, which is of about the same displacement.

	"Maine."	"Benedetto Brin."
Length	388 feet.	413 feet.
Displacement	12,500 tons.	12,765 tons.
Speed	18 knots.	21 knots.
Coal supply	1,000 tons, normal.	1,600 tons, normal.
Belt armor	12-inch maximum.	6-inch maximum.
Citadel armor	7-inch.	6-inch.
Barbette armor	12-inch maximum.	10-inch maximum.
Main battery	Four 12-inch.	Four 12-inch.
Intermediate battery	None.	Four 8-inch rapid-fire.
Secondary battery	Sixteen 6-inch, twenty 6-prs., six 1-prs.	Twelve 6-inch, ten 12-prs., six 3-prs.

The adjoining table shows that while the armament of the Italian ship is far more powerful than that of the "Maine"—the difference being due to the rapid-fire 8-inch guns—the "Maine" is much better protected, the belt being 100 per cent thicker and the barbette protection 12 inches as against 10 inches. We greatly regret that the "Alabama" and "Maine" classes do not carry any 8-inch guns. This weapon has been particularly identified with United States warships; it proved to be the most effective of all the guns in use at Santiago and Manila; and ever since Armstrong showed the practicability of applying the rapid-fire mechanism to it, its destructive powers have been enormously increased. The four 8-inch guns of the "Benedetto Brin," with their high command of 28 feet and their good protection, would give the Italian vessel a marked theoretical advantage in an artillery duel with the "Maine." The 12-pounders and 3-pounders of the "Brin" are preferable to the 6 and 1-pounders of the "Maine."

We place particular stress upon these points in the hope that before the contracts are let for our new 13,500-ton battleships, authorized by the last Congress, such changes may be made as will admit of the reintroduction of the 8-inch gun and the substitution of the 12 and 3-pounders for the 6 and 1-pounders. The use of Krupp in place of Harvey armor (supposing Congress desists from its obstructionist policy in the matter) would greatly reduce the total weight of the armor and compensate for the added weight of the 8-inch guns, mounts, and ammunition.

COAST DEFENSE VESSELS.—The Italian navy is but poorly provided with coast defense vessels pure and simple. Like Great Britain, she favors an aggressive policy, placing her floating armaments in large ships of good speed and sea-keeping qualities. Moreover, her principal strategic points are well protected by fixed fortifications. The coast defense type is represented by five small armored vessels that were built over a quarter of a century ago. They are the "Affondatore" (4,062 tons), built at Millwall, London; and the "Ancona" (4,460 tons), the "Castelfidorio," "Maria Pia," and "San Martino" (4,260 tons), built in France. The first named has a 5-inch belt and carries two 28-ton Armstrong guns and six 4·7-inch rapid-firers; the other four have 4½-inch belts and are armed with six 6-inch and six 4·7-inch rapid-fire guns. The speed of all five vessels is 12 knots, and the complement from 300 to 400 men.

ARMORED CRUISERS.—At the opening of the present year there were five armored cruisers built or building for the Italian navy. The most important of these vessels are the twin ships "Vettor Pisani" and "Carlo Alberto," of 6,500 tons, and the "Varese" and "Guiseppe Garibaldi," of 7,400 tons displacement. These very fine ships are modifications of the "Christobal Colon," which was originally laid down at Sestri Ponente for the Italian navy, but was sold to Spain before her completion. They are all distinguished by their unusual protection, which consists of a complete 6-inch belt, a central citadel of 6-inch armor extending over two-thirds of the length, and from the belt to the main deck, and an armored deck. The speed is 20 knots in case of all four ships, and the maximum coal supply is 1,200 tons. The "Vettor Pisani" and her mate carry eighteen guns of the large rapid-fire type distributed as follows: Eight 6-inch on the gun deck in broadside and four 6-inch on the main deck within the citadel, the latter having a dead ahead and dead astern fire; four 4·7-inch on the main deck, between the 6-inch guns; one 4·7-inch on the same deck in the bow and one 4·7-inch in the stern. There are also twenty-two 12 and 3-pounders. The "Varese" and "Garibaldi" have the same armor, speed, etc., but the armament consists of one 10-inch gun forward in a barbette, two 8-inch rapid-fire guns aft in a barbette, ten 6-inch rapid-fire guns in the gun deck battery, and four 6-inch rapid-fire guns at the angles of the main deck battery.

These two ships have a greater energy of gun-fire per minute than any ship built or building in the world to-day; the total being greater even than that of the German "Fürst Bismarck" of 10,482 tons, or the British "Cressy" of 12,000 tons.

The "Marco Polo" is a smaller vessel, of 4,583 tons and 19 knots, whose particulars are given beneath the accompanying cut of the ship. The battery is entirely of the rapid-fire type and is characteristically powerful. The six 6-inch guns are carried, one forward on the forecastle deck, one aft on the poop, and four on the main deck at the break of the forecastle and quarter decks. The ten 4·7-inch guns are all on the main deck, two beneath the forecastle deck, two beneath the poop, and six amidships between the 6-inch guns. In appearance and distribution of armament the armored "Marco Polo" resembles our own protected "New Orleans."

PROTECTED CRUISERS.—The strength of the Italian navy lies in its armored vessels, and in this respect it resembles the Russian navy. What protected ships Italy has built have been small, none of them exceeding 3,600 tons displacement. Of vessels of this class, between 2,000 and 4,000 tons in displacement, there are seventeen, with an average speed of 18 knots, an average displacement of 2,754 tons, and a total displacement of 46,818 tons. There are also twenty-eight small cruisers and gunboats of an average displacement of 886 tons and an average speed of 17·9 knots. None of these vessels call for special remark, unless it be the "Piemonte," of 2,500 tons, built in 1888 at Armstrong's, which was the first warship to be armed with rapid-fire guns. In this respect, and in respect of her at that time unprecedented speed of 21 knots, she is an epoch-marking ship.

We illustrate a typical vessel of each class above mentioned. The "Etruria" is one of three ships built in Italy, between 1890 and 1893. They are 220 tons smaller than the "Piemonte," and carry four 5·9-inch and six 4·7-inch rapid-firers as against six 6-inch and six 4·7-inch rapid-firers. The speed is from 2 to 3 knots less, the deck 2 inches against 3 inches, and they carry 400 against 560 tons of coal. The majority of the protected cruisers are of modern construction, and, as a class, they should prove to be serviceable vessels.

In conclusion, it must be admitted that there has been so much variety, so much experimental designing, in the Italian fleet that only the actual test of war can settle the actual fighting value of its first line of battle. Judged by current ideas, the battleships of the "Duilio," "Andrea Doria" and "Italia" classes are hampered by a slow and cumbersome though admittedly powerful armament, while the "Italia" and "Re Umberto" classes are perilously deficient in defensive qualities other than those which accrue from ability to run away—and the Santiago tragedy would indicate that the latter is an expedient of very doubtful value, to say the least. It is in her armored cruisers, of which it is difficult to say too much in praise, that Italian naval architects have scored their greatest success, and it is not unlikely that the original cruiser-battleship "Christobal Colon" will prove to be the prototype of the standard fighting ship of the future.

Novel Switch for Electric Cars.

Mr. Hiram Stevens Maxim has lately patented a new means of operating the switches of electric cars. It is well known that, in order to get quick acceleration, it is necessary that practically the whole weight of the train should rest on the drivers. It is therefore necessary to provide each car with a motor, and when several cars are coupled together in a train, as they will have to be on the Underground in London, it will be necessary to have a man to each car, or to have some device by which the driver of the front car can control the switches of the entire train, and various devices have been thought out and patented for this purpose.

These all require some connection between the various cars other than the coupling, but by Mr. Maxim's method the drawbar of each car is attached to the switch in such a manner that the switch is operated by the tendency of each particular car to pull back as relates to the drawbar. The drawbar of each car is an inextensible rod running the whole length of the car, with a coupling at each end. This rod is held in a central position by two spiral springs, and is connected to the switching device of the car in such a manner that, no matter in which direction the bar is moved as relates to the car, it switches in the current which moves the car in the same direction. Therefore, each car follows the drawbar automatically, and the motor of each car does just sufficient work to propel that particular car. This device is of great simplicity and is easily understood, as it requires no coupling or connection between the various cars of the train except the coupling itself.

THE BIRD GIANTS.

BY CHARLES FREDERICK HOLDER.

Among the big things which the State of California produces are ostriches. It has been found that the mild climate of Southern California is remarkably well adapted for the purpose, and that ostriches breed and thrive as well here as in their native African haunts. The experiment was first tried by an Englishman, Mr. Edwin Cawston, who, in 1885, bought fifty-two birds in South Africa. It was a hazardous experiment, as the big birds are extremely difficult and dangerous to handle; but forty-two were landed on American soil. From these pioneers the fine ostrich farm at Pasadena, Cal., has grown, which at present contains two hundred birds. Here one can study the history of these birds from the egg to the adult; and as the industry is now protected by an import duty of 20 per cent, the ostrich farm is on a sure financial basis and has become one of the paying American industries.

The Pasadena ostrich farm is beautifully situated among a grove of live oaks on the Arroyo Seco, between the cities of Pasadena and Los Angeles. The inclosure of several acres is divided into corrals in which the various classes of birds are seen. As we enter, the birds approach in droves with a queer mincing gait, ludicrous in the extreme. The ostrich impresses one as being the type of stupidity, posing as a very wise personage; its large body, small head and brain, constructed on economical principles, its enormous eyes, all carrying out the idea.

The birds are fearless and approach visitors, taking food from their hands. The correct thing to do seems to be to feed oranges, which are devoured whole, the diversion being mutual, as the orange presents a remarkable appearance as it passes down the long neck of the bird. The keeper, who tells us that he was once nearly killed by a bird, is a fund of information, and from him we learn all the secrets of running an ostrich farm. First, one must have the birds, which cost from one thousand dollars upward apiece in Africa; but, as they breed when they are three years old, there is a quick return.

There is a definite arrangement in the corrals. The best-feathered are selected and paired, space being left between the males, which fight and often kill one an

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other. During the laying time, it is often dangerous to approach them, the males rushing to the attack, and, by a forward downward kick, producing a serious wound, often fatal. Horses and even men have been killed; and when the charge is made, the keepers find safety by lying flat on the ground.

The adult birds are magnificent creatures, standing seven feet high and weighing two hundred and fifty pounds. One of the interesting sights is to see them feed. They literally eat anything, according to the keeper, but are maintained on alfalfa. Among the extraordinary things that have been snatched from the hands of visitors and others and swallowed are nails, a gimlet, lighted pipes, a rolled newspaper. The writer once saw an ostrich snatch a bonnet from a lady's head and swallow it; but in this case a green veil that was the bonne-bouche caused the animal's death. With their food of alfalfa and vegetables, the birds are provided with broken shell for the lime, and quantities of pebbles, which they swallow to aid in grinding the food.

The breeding season, at which time we are fortunate in making our visit, is in early spring. The male bird now becomes very active and ugly. He rests his breast bone on the ground at some selected spot, and with his powerful claws throws the dirt away, turning round and round during the operation, until a shallow hole is the result, by courtesy a nest. In this work the female sometimes joins. When it is complete, the hen takes her place and lays an egg every other day. And what an egg it is! One would make an omelet for thirty men with moderate appetites, as one weighs three pounds and is equal to thirty hen's eggs. When twelve or fourteen eggs have been deposited, the birds scatter a little sand over them and begin the labor of hatching them, dividing their time with almost mathematical precision, and presenting a remarkable instance of the sense of responsibility in both male and female. The male takes his place at four o'clock in the afternoon and covers the eggs. At nine o'clock in the morning he is relieved with all the promptness of a sentinel by the female; and it is an interesting point to notice that at noon, though the male is off duty, he relieves the female for an hour, allowing her to take a rest and obtain food. This can be seen by every one, as the nests are in the open corral, and nesting carried on for nearly six weeks.

If one could approach the eggs now in the absence of both birds, a curious tapping would be heard on the shells, called "telephoning" by the keeper. In a word, the chicks have arrived and are knocking for admission into the world. Some succeed in breaking out; others have to be assisted, and the hen will press gently upon them at such times and break the shell; then she will take the youngster in her bill and pick it out, shaking the bits of shell from it.

The baby birds are most attractive little creatures, covered with wiry, hairlike feathers and possessed of the greatest curiosity. They are at once taken from the parents and brought up by hand in nurseries especially arranged for baby ostriches. They are turned into a field of alfalfa during the day and at night kept in warm boxes or artificial mothers. For two or three days they do not seem to care to eat. Then they eat stones and bone crushed, and on the fifth day alfalfa, from now on growing rapidly, so that at the age of six months they are six feet high, having grown at a rate of a foot a month; after this the growth is slower.

The reason for taking the young from the mother is a purely business one, as the birds immediately build another nest, which they would not do if the young were left with them to rear; so instead of one brood a year the owner obtains seventy or eighty eggs from a single bird. In six weeks the chicks are tall and robust birds, beautifully spotted and rapidly becoming valuable commodities. At a year old they are valued at $150 per pair; chicks three to six weeks old, $40 a pair; while the full grown bird is valued at $300 per pair. It is evident then that the ostrich is within the reach of the average individual; yet there are some drawbacks, as an ordinary ostrich has an appetite that, apparently, has no limitations, and one will literally eat a poor man out of house and home.

The birds are valued for their feathers, for which there is a growing demand, and if the visitor is present at the farm during what is termed the "picking," he or she is well repaid. The full-feathered bird is a beautiful creature, but every feather is not valuable or a plume. The feathers are of many kinds and differ widely. In the very young birds they are yellow and white, later dark drab on the male, black and white in the female. The fine plumes are found on the adult male and to bring the best price should be taken from the living bird, those from the wing being the most esteemed, especially the so-called ivory-colored plumes.

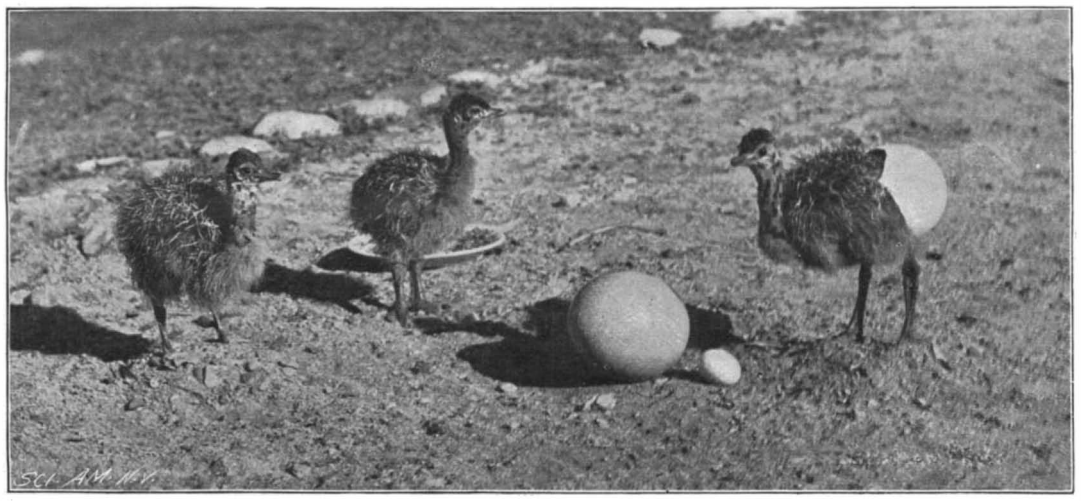
The picking of the feather crop occurs every few months, the occasion being not only interesting but exciting, as the birds protest decidedly to the robbery. The pickers are men skilled in the business; necessarily so, as poor picking ruins feathers and birds. When picked, the feathers are what is termed ripe; that is, they would soon be thrown off by the moulting process, consequently there is little or no pain in the operation. The heavy plumes are cut off, the stumps being removed three months later.

At this picking time the birds are separated and driven into a narrow pen, their heads being covered with a perforated bag. The men station themselves behind, so that the bird cannot kick, and holding it securely the picking is performed in view of the large audience that usually collects at this time. Three crops of feathers are obtained in about two years, each bird being estimated to produce $30 per year in feathers; and as each bird attains an age of from fifty to even seventy years, the profit of feathers alone is enormous, not to count the young. As the feathers are collected they are classified and placed in bags: those of the males in one, those of the females in another, as all have some peculiar market value, and the grades are well recognized by the trade. When graded and weighed, they go to the expert feather dressers of Los Angeles, San Francisco, and New York. Here they are tied on strings four feet in length, or in bunches, classified thoroughly, and are then sent to the dyer, as no matter whether the feather is naturally black it is dyed black. After this they are washed in water and starch; the latter is then removed when they are ready for the "finisher," where they are graded, assorted, sewed together, often three or five pieces to make one plume; they are then steamed to allow the fibers to take their natural position. The curler now takes them, and gives the plume the graceful shape so desired. From the hands of the curler they pass to the man called the "buncher," who combs them out and gives them the particular shape demanded by fashion. Now the plume or feather is ready for the market and is placed on sale. The history of the feather from the hatching of the young ostrich to the beautiful plume on the hat of some lady is a long and complicated one.

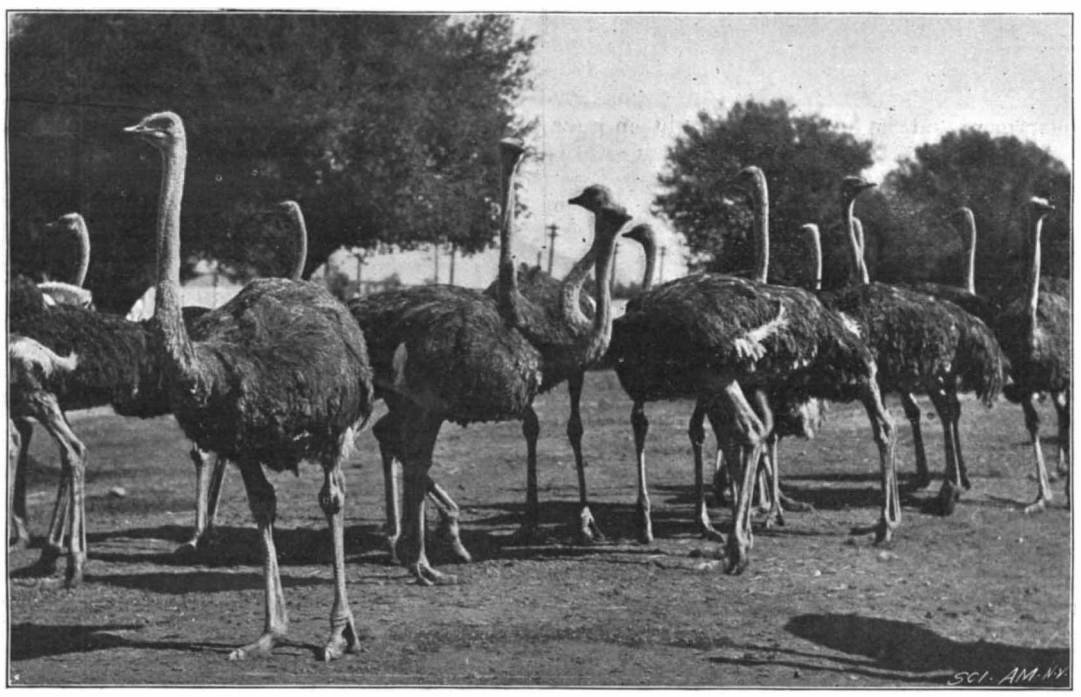
The commercial side of the industry is not without interest. Birds are sold to circuses and shows; the unfertile eggs bring a dollar apiece as curiosities; the feathers are made into boas, which range from $3 to $35; capes, ranging from $16 to $25; fans, tips, single plumes, collarettes, and other objects, suggestive that ostrich farming must be a profitable business; indeed, in South Africa it was at one time ranked next to that of the diamond in point of value.

But the interest in the farm to the average visitor consists in the birds and their strange habits; whether bathing in the pool, or walking jauntily around the corral, or sailing along with outspread wings, they present a fascinating spectacle. The strength of the male ostrich has been the subject of many experiments at the Pasadena farm, and not the least interesting is the great bird used as a saddle horse; a boy mounting the steed and riding it about, the bird carrying its load with the greatest ease. The birds have also been harnessed and driven tandem, to the delight of the young people.

A visit to this farm corrects many errors that may have found place in the mind of the observer. The ostrich does not thrust its head in the sand to avoid its enemy, but boldly charges horse or man, though, sad to relate, a dog will demoralize the entire herd. This is because the ostrich knows that it cannot strike so small an animal. That the birds allow the sun to hatch their eggs is another fiction exploded by a visit to the ostrich farm. No hen displays greater solicitude than does this gigantic mother, who is constantly robbed of her chicks, never enjoys the pleasures of maternity, of leading her young about, but is kept nestling the year around. If allowed to care for her young, the mother ostrich proves to be a famous care-taker. She exercises them all day long, forcing them to run and eat, and at night gives them shelter beneath her warm plumes — the giant mother of the bird creation.



JUST OUT OF THE EGG.



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A CALIFORNIA OSTRICH FARM.

The Current Supplement.

The current SUPPLEMENT, No. 1222, is a most interesting paper, filled with important articles. "A Powerful English Express Locomotive" forms the front page article. Dr. Merrick Whitcomb's article, "Student Life at the Close of the Middle Ages," is one in the University of Pennsylvania Lecture Course and is most interesting. "The Progress of Submarine Navigation" is accompanied by 27 sectional views, showing the principal types of submarine boats of the world. This is a very valuable paper on the subject. "Samoa's Latest Troubles" is accompanied by 10 illustrations giving an excellent idea of the country and its inhabitants. "Crime and the Weather" is an original and important treatise by Edwin Grant Dexter. "The Cork Tree—Its History and Use" is by Nicolas Pike. "Ætheric Telegraphy" is a paper by Prof. W. H. Preece. "Liquid Air an Explosive" is an article by F. H. McGahie; this is an important paper by an expert in explosives.

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RECENTLY PATENTED INVENTIONS.

Mechanical Devices.

AUTOMATIC PICTURE-EXHIBITOR. — John Heissenberger, Manhattan, New York city. In this coin-operated picture-exhibitor are included a picture-carrier and two co-operating motors. One of the motors drives the picture-carrier. The other motor is provided with a time-wheel having peripheral slots for the passage of projections on the picture-carrier. The time-wheel controls the length of time a picture is to be exhibited. The pictures are illuminated by an incandescent electric lamp, so that they may be clearly seen through an eye-piece. A coin-receiving lever is arranged to start or stop the motor and to make or break the circuit of the lamp.

MAILER.—James A. Horton and Chauncey Wing, Greenfield, Mass. The present invention provides improvements in mailers of that type which are operated by hand and cut an address from a printed slip and paste that address upon the wrapper or envelop to be mailed. The improvements are concerned chiefly with the cutter-blades and their operating mechanism, and comprise a fixed cutter-blade having a pivot located near one end. An auxiliary pivot at right angles to the main pivot, is supported to swing thereon. A cutter arm or blade is pivoted upon the auxiliary pivot and is adapted to engage the fixed blade.

DRIVING-GEAR.—Thomas R. Jarvis, Stockbridge, N. Y. This invention is chiefly concerned with driving-gear operated by a wind-wheel. The gear provided is so constructed that the band-wheel at the lower portion of the shaft may be turned on a horizontal plane to any desired position, and secured so that it may be placed in band connection with any one of a number of machines placed variously around a barn floor or the like. One band, which may always be an open belt, will run the machine in either direction. By this invention, all the benefits of line shafting are obtained.

COMBINED STONE GATHERER AND ROLLER. —Edgar A. Nugent, Unionville, N. Y. The stone-gatherer is provided with a transverse comb which discharges into an endless bucket-elevator. A wheel is mounted in advance of the comb and is formed with rows of yielding fingers to throw the stones or rubbish upon the comb. The fingers are spaced apart to pass through the spaces between adjacent teeth of the comb and to move the stones forward on the comb until they fall into the buckets of the elevator.

BORING OR DRILLING MACHINE.—Lot Person, Cartwright, Penn. It is the object of this invention to provide a drill which can be used in places where the ordinary drill would be ineffective. With this object in view, mechanism has been devised in order to place the drill-holder at one edge of the device, so that it may be used close to the roof of a tunnel, thus enabling one to drill a hole parallel to the roof.

MITER-BOX.—Theodore Bootsman, Arctic, Wash. Connected with a vertically-adjustable cross-bar is a horizontal swinging arm moving with the cross-bar, and fixed in different angular positions by locking devices to suit the angle or miter cut of the saw. The saw is guided by two suspended, flanged, guide-plates. Clamping bolts are also provided, one of the bolt connections being slotted to permit adjustment between the plates. To prevent their turning on their clamping-bolts, the plates have an interlocked or notched joint with the arms.

FIREARM. — Harry E. Brown, Grinnell, Iowa. A casing is located at the breech of the gun, in which casing a spring-pressed firing-pin is mounted to slide. The hammer of the gun operates a stop-lever which is arranged to engage a projection on the firing-pin to prevent a recoil thereof during a discharge. A simple and convenient locking mechanism is provided between the barrel and the stock. The movement of the firing-pin can be limited in its bearings by means of a collar which engages the rear wall of the casing in which the pin slides, when it has been forced from the cap-chamber upon cocking the hammer.

MEASURING-DEVICE FOR CLOTH.—Thomas S. Jones, Prince Albert, Saskatchewan, Northwest Territories, Canada. The cloth-measuring device comprises a base having a cloth-receptacle at one end and an adjustable winding device at the other end. On the base two rollers having bearings in uprights are mounted. The cloth to be measured is placed in the cloth-receptacle. One end of the cloth is then run between the rollers and attached to the board upon which it is to be wound. By turning the winding-device the cloth will be drawn between the rollers; and the rollers in rotating will, by means of intermediate gearing, move a finger or pointer over a yard-scale to indicate the number of yards wound from one board to another. A machine of this character will be of especial service in taking stock.

Miscellaneous Inventions.

PIPE-CLEANING ATTACHMENT. — Heinrich Wenz, Bronx, New York city. This device comprises a centrally perforated frame or plate secured upon the exterior of the pipe, the pipe having a hole corresponding with the central hole. A cover-plate is secured to the frame by screws. The cover-plate may be made flat and thin, so as to be readily bent to conform with any-sized pipe. This bending may be done in the process of manufacture or by the working-men when applying the device to the pipe. By this means it is possible to obtain access to the interior of the pipe by removing the cover-plate and to permit the insertion of wires or other cleaning-tools.

EXTENSION-TABLE. — Randolph F. Westerfield, Manhattan, New York city. The two end sections of the table are adapted to move toward and from each other. Levers are fulcrumed upon the table and are adapted to raise and lower the extension-levers. Rods used in connection with the levers slide in guide-ways. As the end sections are moved apart, the rods first slide idly and then upon reaching the limit of their sliding movement serve to throw the levers so as to lift the extension leaves. In this manner the folded leaves can be brought into position upon extending the table, to complete the extension-table top.

TENSION DEVICE FOR FENCE-WIRES.—Joseph C. Barnes, Summit, Miss. The tension device has a frame with clamps adapted to bear downwardly upon the lowermost fence-wire. A windlass is mounted upon the upper portion of the frame. A clamp connected with the windlass is adapted to exert upward tension on the top wire. By means of this device the wires will be firmly supported and held while the stays, which are usually placed between the posts, are twisted together.

KNIFE WITH CONNECTED BLADES.—Gustave Bay, Paris, France. The knife of this inventor has connected blades by means of which meat can be properly cut into small pieces. The blades are of the same length; and their cutting parts, though parallel, are so arranged that the knife edges of the intermediate blades project beyond those of the outer blades when in the position of rest, and that the intermediate blades can give way progressively when the knife is used to the extent of having all the blades in operation. The knife can be easily taken to pieces, so that the blades can be readily cleaned and sharpened.

MEASURING DEVICE.—Morris Ecker, Brooklyn, New York city. The device comprises a train of counting-wheels, one of which rolls upon the object to be measured. Each wheel has a crank and pin; and all of the cranks are in the same direction from their respective centers when the wheels are in zero position. A slide movable in the direction of the cranks when in this position, has a pair of cam projections for each crank extending from opposite sides and adapted, when the slide is reciprocated, to engage the crank-pin and turn the counting-wheels to zero position.

COMBINED SMOKING-TUBE AND CIGAR-HOLDER.—James M. Eder, Manhattan, New York city. It is the object of this invention to provide a combined smoking-tube and cigar-holder, which is fitted with a simple means for charging the tube with tobacco or a cigar and also for discharging the ashes of the tobacco or the stump of a cigar. The body and the mouthpiece of the device are mounted to rotate one relatively to the other. A spiral wire feeder in the body has connection with the mouthpiece. By rotating the feeder in one direction tobacco or a cigar can be drawn into the tube. By rotating the feeder in the opposite direction, the ashes of the tobacco or the stump of a cigar will be discharged.

LEAK-STOPPER. — Carl Eibee, Brooklyn, New York city. The leak-stopper provided by the present invention consists of a body constructed in two sections, the inner surfaces of which are shaped to conform with the exterior surface of a pipe. Each section is provided with side flanges. Lugs projected from the side flanges of one body-section are adapted to enter recesses in the side flanges of the opposing body-section. Keys receive the flanges and lock together the corresponding flanges of the body-sections, so that the device is firmly secured over the leak without danger of slipping.

WALL-PROTECTOR. — Richard L. Hardin, Chicago, Ill. The wall-protector is designed to prevent the soiling of wall-decorations when cleaning windows, door-frames, or base-boards. The wall-protector comprises a flanged blade or plate provided with a handle. The inner edge of the blade is brought against the window-casing and rests upon the wall. The blade is given an inclination to the woodwork to be cleaned, so that the water cannot flow behind the device. It should also be remarked that the protector may be held by one hand against the wall and in engagement with the woodwork to be cleaned, leaving the other hand free for cleaning.

BAG-FRAME.—Louis B. Prahar, Brooklyn, New York city. The present invention relates to an improvement in the frames of chatelaine-bags, the object being so to construct the frame that an ornament of any design can be readily applied thereto. The frame provided for this purpose can be termed a "stock-frame," since front ornaments of various designs can be attached to stock-frames so that all the features of the design can be displayed—a result which could not be obtained in the old construction.

FISHING-NET SINKER. — John C. Robinson, Hampton, Va. This sinker has a body formed with a longitudinal slot. The sinker-body is passed sidewise upon the bottom line of the net and a double wedge is driven into the slot in order securely to clamp the line in position in the bottom or inner wall of the slot.

BELT-BUCKLE. — Louis Sanders, Brooklyn, New York city. The buckle consists of mating members having a stud-and-slot connection, one of the members being provided with a fixed projection and the other with a recess, whereby when the members are brought to a locking position, the projection is automatically sprung into the recess. The buckle is designed particularly for use upon military and cartridge belts.

WINDOW LOCK AND REGULATING DEVICE.—Lawrence F. Ryan, Manhattan, New York city. The inventor employs plates for attachment to window-sashes, which plates are provided with L-shaped openings. A locking-bracket is provided, having a triangular body and an arm pendent therefrom. The body and the arm of the bracket are provided with T-shaped lugs adapted to enter the openings in the plates. This simple device is designed to lock a window in an open, partially open, or closed position, so that the locking parts cannot be tampered with from the outside.

SCREW-DRIVER. — Burnside E. Sawyer, Fitchburg, and William D. Arnott, Athol, Mass. The beveled sides of the ordinary screw-driver blade often slip out of the nick of a screw and thus deface and injure the screw-head. The inventors of this improved screw-driver have devised a series of insertible and removable, parallel-sided or flat blades of high grade or tool-steel for a common holder or stock. The new form of screw-driver, it is said, overcomes the disadvantages of the old form.

SURFACE-GAGE.—Burnside E. Sawyer, Fitchburg, Mass. This invention seeks to provide an improved surface-gage of that class in which a quick primary adjustment and a second finer adjustment of the scriber may be effected. To this end the inventor employs a base having a slot which permits the gage-bar, with its attached scriber, to swing through a wide arc, a rotatable eccentric being provided for effecting the fine adjustment of the gage-bar and scriber.

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(7666) F. W. asks: 1. What amount of water at a temperature of 40 degrees is required to condense 10 gallons of brandy per hour from a still of that capacity? A. If the still tank is fed from the bottom and overflows from the top at 80 degrees F., 76 gallons of water will be required to condense 10 gallons of brandy spirits per hour. 2. What means are taken to condense the lighter hydrocarbon oils, such as gasoline, naphtha, etc., from the heavier oils? A. The lighter hydrocarbon oils are the first distillate from crude petroleum. The vapors pass through the same still as the heavier oil, but are switched off into separate tanks as the gravity of the distillate increases. The gravity is tested as the liquid flows by a hydrometer. 3. In making ice by aid of expanded compressed air (or ice machines), what amonnt of compression must the air reach in order to get best effects as found in practice? A. The most economical air pressure for refrigerating or ice making is 60 lb. per square inch. 4. What power would be required to make 10 pounds of ice from 10 pounds of water at a temperature of 70 degrees in say 30 minutes? I figure for above, taking the sulph. ether kind of machine, that it would require one horse power exerted for a space of 41⅓ minutes (nearly) to convert 10 pounds water at a temperature of 70 degrees into ice at 32 degrees. Am I right? A. One horse power should produce 17 pounds of ice in 30 minutes in a small ice making machine. You are nearly right in your figures. 5. What is the practical limit that air compression could be used for freezing or refrigeration purposes without the aid of ammonia, ether, or bisulphate of carbon? A. We do not know that there is a practical limit for compressed air refrigeration. It is largely used for cold storage in ships, and can only be limited by the additional cost over ammonia and bisulphide plants. 6. What are the best works upon the above subjects and are they treated in the Scientific American Supplement? A. We recommend Siebel's "Compend of Mechanical Refrigeration," $2.50 by mail; "Theoretical and Practical Ammonia Refrigeration," by Redwood, $1 by mail.

(7667) H. G., Jr., asks: What book will give me the most detailed description of multiphase alternating motors, especially the three-phase type in the smaller sizes? I want a book treating in detail the winding of armature, field, etc.; which would you suggest, and name price. A. The standard work on polyphase motors is Thompson's, a revision of which is expected soon. Watch our book list in Scientific American Supplement. A new book on the same subject has been published this year, Oudin's "Polyphase Apparatus," price $3 by mail. This is an American work. The exhaustive work on "Armature Winding" is Parshall & Hobart's, price $7.50 by mail.

(7668) J. E. K. asks: 1. What length crank is best with a 91 gear? The back sprocket has 8 teeth. Why is a short crank used in some cases and a long one in others? A. The length of crank on a bicycle is, within certain limits, a matter of personal preference. With a long crank the pressure on the pedal is less, but the feet must move faster and through a longer distance for each revolution. With a short crank the pressure is greater, but the distance traversed by the feet is less. Each one must settle for himself which length suits him best. 2. Is it the light itself or the heat in the light which propels the disks of a radiometer such as are seen in opticians' stores? A. It is the radiant energy absorbed as heat by the carbon on the vanes of the radiometer which causes its motion. The black sides of the vanes become hotter than the bright sides, and the molecules of the residual gas gain from the hot side a greater velocity, which produces a greater pressure on that side of the vane. Hence a motion is produced by reaction.

(7669) R. L. C. asks: In cigar lighter spark coils, has the spark coil a primary and secondary coil, and how are they attached to battery so that the circuit can be closed from the lighter? A. The spark coil has only a primary winding. The coil battery and lighter are connected in series. The spark is given when the circuit is broken by the lighter.

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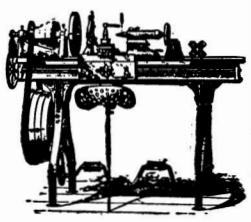

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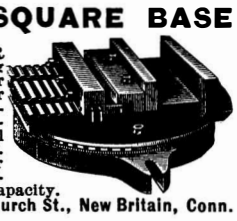

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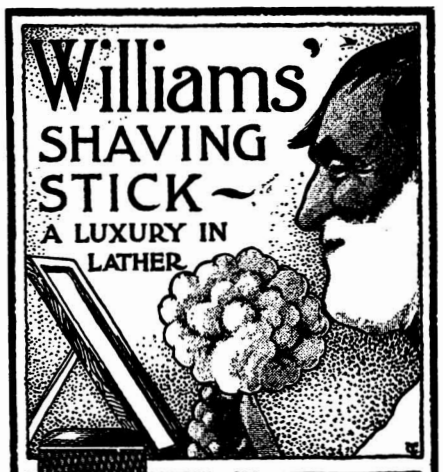

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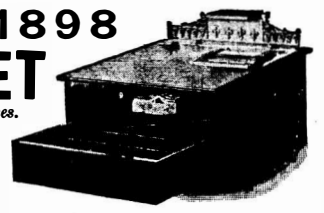

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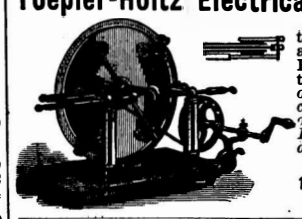

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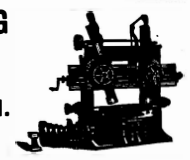

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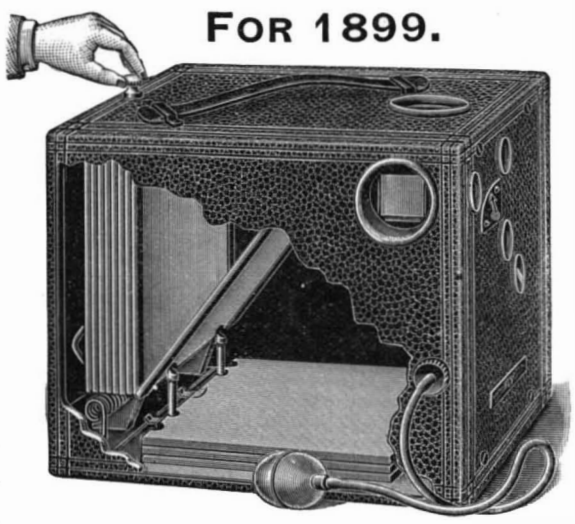

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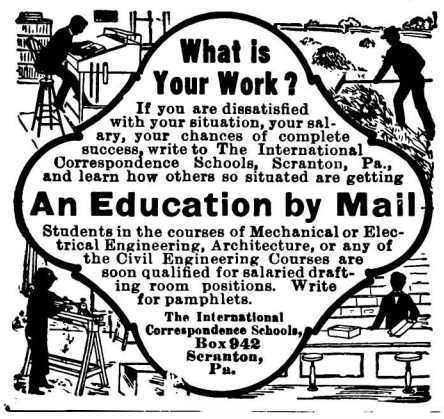

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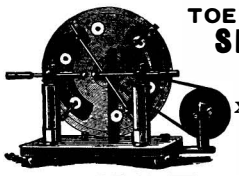

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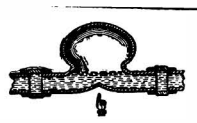

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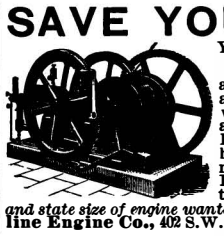

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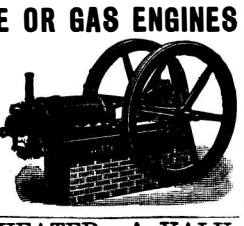

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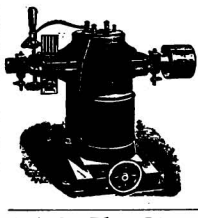

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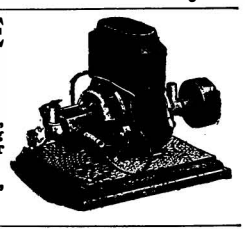

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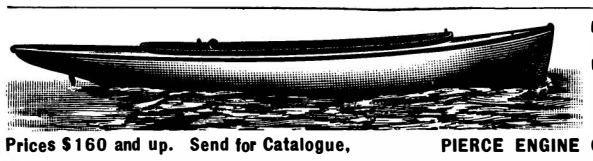

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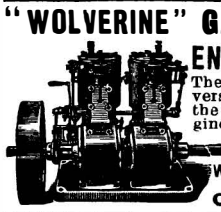

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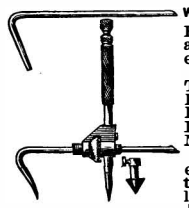

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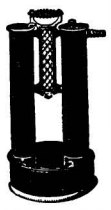

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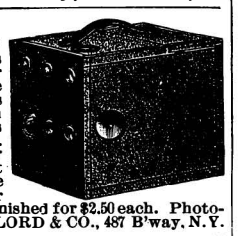

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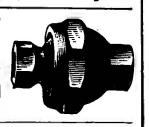

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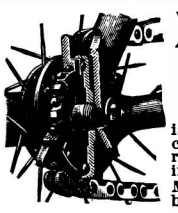

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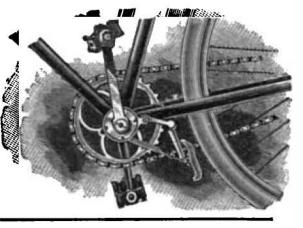

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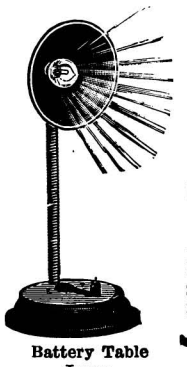

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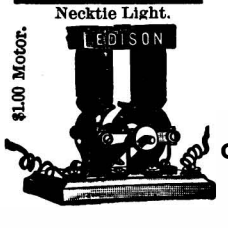

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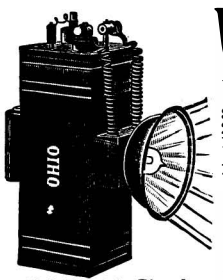

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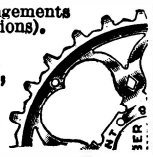

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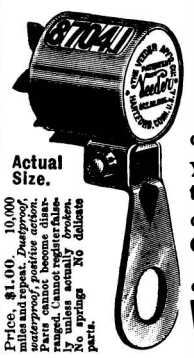
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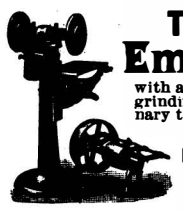

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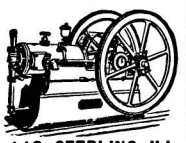

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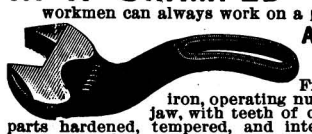

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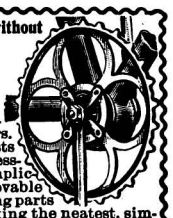

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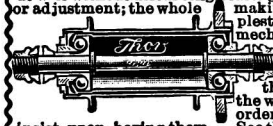

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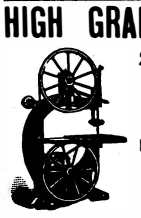

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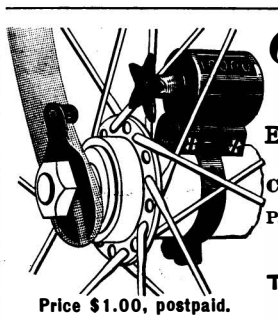

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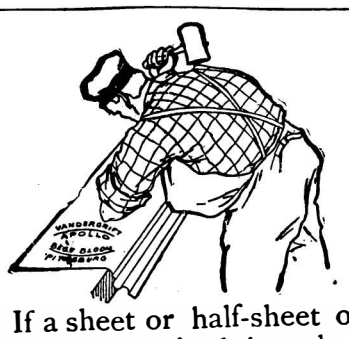

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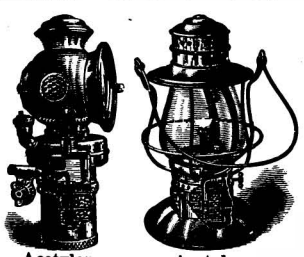

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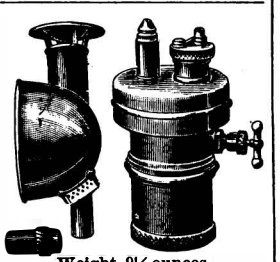

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